ZOONOSES MONITORING

SWEDEN

The Report referred to in Article 9 of Directive 2003/ 99/ EC

TRENDS AND SOURCES OF ZOONOSES AND ZOONOTIC AGENTS IN HUMANS, FOODSTUFFS, ANIMALS AND FEEDINGSTUFFS

including information on foodborne outbreaks, antimicrobial resistance in zoonotic agents and some pathogenic microbiological agents

IN 2006

INFORMATION ON THE REPORTING AND MONITORING SYSTEM

Country: **Sweden**
Reporting Year: **2006**

PREFACE

This report is submitted to the European Commission in accordance with Article 9 of Council Directive 2003/ 99/ EC[1]. The information has also been forwarded to the European Food Safety Authority (EFSA).
The report contains information on trends and sources of zoonoses and zoonotic agents in Sweden during the year 2006. The information covers the occurrence of these diseases and agents in humans, animals, foodstuffs and in some cases also in feedingstuffs. In addition the report includes data on antimicrobial resistance in some zoonotic agents and commensal bacteria as well as information on epidemiological investigations of foodborne outbreaks. Complementary data on susceptible animal populations in the country is also given.
The information given covers both zoonoses that are important for the public health in the whole European Community as well as zoonoses, which are relevant on the basis of the national epidemiological situation.
The report describes the monitoring systems in place and the prevention and control strategies applied in the country. For some zoonoses this monitoring is based on legal requirements laid down by the Community Legislation, while for the other zoonoses national approaches are applied.
The report presents the results of the examinations carried out in the reporting year. A national evaluation of the epidemiological situation, with special reference to trends and sources of zoonotic infections, is given. Whenever possible, the relevance of findings in foodstuffs and animals to zoonoses cases in humans is evaluated.
The information covered by this report is used in the annual Community Summary Report on zoonoses that is published each year by EFSA.

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[1] Directive 2003/ 99/ EC of the European Parliament and of the Council of 12 December 2003 on the monitoring of zoonoses and zoonotic agents, amending Decision 90/ 424/ EEC and repealing Council Directive 92/ 117/ EEC, OJ L 325, 17.11.2003, p. 31

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1. ANIMAL POPULATIONS

The relevance of the findings on zoonoses and zoonotic agents has to be related to the size and nature of the animal population in the country.

A. Information on susceptible animal population

Sources of information:

Most information about numbers of animals or herds is derived from the Yearbook of Agricultural Statistics 2006, Swedish Board of Agriculture, including data from 2005. Some information about the number of slaughtered animals has been collected by the National Food Administration.

Dates the figures relate to and the content of the figures:

Most data relates to 2005.

Definitions used for different types of animals, herds, flocks and holdings as well as the types covered by the information:

The definitions used in EU legislation are also used in Sweden.

National evaluation of the numbers of susceptible population and trends in these figures:

The dairy sector plays a central role in Swedish agriculture. The number of dairy cows has, however, been decreasing over a long period of time. The number of farms with livestock is decreasing whereas those that remain increase their number of animals. For example, all herds with fewer number of cows than cows has decreased. In 2005, there were dairy cows in around 8500 farms. This is a decrease with 7 % compared with 2004. On the same time, herd size increased from 44 cows/ herd to 46 cows/ herd.
In 2005 there were roughly 2800 pig farms in Sweden. This is a decrease by around 85% since 1980. Also, the number of pigs are falling, and the decrease was greatest during the 1980's. Around 98 % of the fattening pigs are found in herds with at least 100 animals.
The number of sheep herds are decreasing, but the increasing herd sizes have resulted in a slight increase in the total number of animals. Egg production is dominated by few but large flocks. Around 90 % of the hens of laying breed are found in herds with at least 5 000 hens. The number of hens increased during the 1980's but have now reached the lowest level in many years.

Geographical distribution and size distribution of the herds, flocks and holdings

Most farms are located in the south and central parts of Sweden and animal husbandry is the dominant line of production. Only in the central part of Sweden the cropping farms dominates. In the north of Sweden there are mostly small farms.

Table Susceptible animal populations

* Only if different than current reporting year

Animal species	Category of animals	Livestock numbers (live animals)	Year*	Number of slaughtered animals	Year*	Number of holdings	Year*	Number of herds or flocks	Year*
Cattle (bovine animals)	mixed herds (1)								
	dairy cows and heifers (2)	393263	2005			8548	2005		
	meat production animals	176613	2005			12821	2005		
	calves (under 1 year)	508495	2005	32481	2006	22888	2005		
	in total	1604933	2005	465225	2006	26179	2005		
Deer	farmed - in total	22361	2006			635	2006		
Ducks	in total			20710	2006				
Gallus gallus (fowl)	broilers			72905571	2006				
	parent breeding flocks, unspecified - in total			666781	2006				
	laying hens			3209807	2006				
Geese	in total			22576	2006				
Goats	in total	5509	2003	560	2006				
Ostriches	farmed			852	2006				
Pigs	breeding animals	188112	2005			3026	2005		
	fattening pigs	1085304	2005			2306	2005		
	in total (3)	1811216	2005	3033740	2006	2794	2005		
Reindeers	farmed - in total (4)	262000		71633					
Sheep	animals under 1 year (lambs)	249275	2005			6666	2005		
	animals over 1 year	222009	2005			7595	2005		
	in total	471284	2005	212548	2006	7653	2005		
Solipeds, domestic	horses - in total	283100	2004	3009	2006	56000	2004		
Turkeys	in total			489921	2006				
Wild boars	farmed - in total (5)			142	2006				

(1): only dairy cows
(2): only beef cows
(3): Numbers from June 2005
(4): Renaret 2005/ 2006
(5): slaughtered at slaughterhouse

2. INFORMATION ON SPECIFIC ZOONOSES AND ZOONOTIC AGENTS

Zoonoses are diseases or infections, which are naturally transmissible directly or indirectly between animals and humans. Foodstuffs serve often as vehicles of zoonotic infections. Zoonotic agents cover viruses, bacteria, fungi, parasites or other biological entities that are likely to cause zoonoses.

2.1. SALMONELLOSIS

2.1.1. General evaluation of the national situation

A. General evaluation

History of the disease and/ or infection in the country

The Swedish Salmonella control programme was initiated in 1961. In 1995, the parts of the programme that covered cattle, pigs, poultry and eggs, were approved by the EU (95/ 50/ EC) and extended surveillance was initiated. The results showed that Swedish red and white meat and eggs virtually are free from Salmonella.
Of the reported human cases, only about 15% are reported as domestic acquired salmonella infection. This figure has been stable throughout the years and is based on information reported from the physicians.

National evaluation of the recent situation, the trends and sources of infection

The national situation remains very favourable. The last four years the number of reported human cases has been very stable with an annual incidence of about 40/ 100 000, including domestic and imported cases, and 6-9/ 100 000 for the domestic cases. In food producing animals, only a few cattle and poultry farms are put under restriction following reported salmonella infection per year, and none or only a few pig farms.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

If Salmonella is diagnosed in a food-producing animal, measures are always taken to trace and eliminate the infection. All food contaminated with Salmonella is deemed unfit for human consumption.

Recent actions taken to control the zoonoses

The Swedish Salmonella control programme has been shown to be an efficient tool to identify Salmonella early in the production chain to keep domestically produced food free from contamination.

2.1.2. Salmonellosis in humans

A. Salmonellosis in humans

Reporting system in place for the human cases

Surveillance is mainly based on passive case findings. Also, contact persons are sampled when there are cases/ outbreaks of salmonellosis. In this report the total number of cases is based on reports from both the laboratories and the physicians. Information about country of origin is available only in the reports from the physicians. Investigations to trace the source of the infection are always performed.

Case definition

A case is defined as a person from whom Salmonella, of any serotype, has been isolated, including subclinical infections. Furthermore, a case is considered to be of domestic origin if the person has been infected in Sweden, thereby domestic cases will also include secondary cases to people infected abroad, as well as people infected by food items of non-domestic origin. A case is considered to be of foreign origin if the person has been abroad during the incubation period for salmonellosis.

Diagnostic/ analytical methods used

Cultivation of Salmonella. Since 2005 serotyping of strains is undertaken at the national reference laboratory only as routine procedure in cases suspected to be infected in Sweden. Phagetyping of S. Typhimurium and S. Enteritidis. PFGE when needed.

Notification system in place

Salmonellosis is a notifiable disease under the Communicable Disease Act (both from the laboratory and from the physician).

History of the disease and/ or infection in the country

The total number of cases between 1995 and 2006 ranged from 3,562 to 5,137. During the same period, the number of domestic cases varied from 453 to 947. Around 85% of all reported cases were infected abroad.

Results of the investigation

Under 2006 the number of reported cases of Salmonella increased on the previous year to 4056. The number of domestic cases also increased on 2005 from 661 to 1010 cases. This is the highest number of domestic cases reported since 1999 (947 cases) but not as high as seen in 1991 (1215 cases). This increase can be partly explained by several outbreaks reported in 2006 and more complete information on country of infection.
Twelve outbreaks of Salmonellosis were reported in 2006. The largest outbreak that year was in the autumn and involved at least 115 persons who became ill after dining at the same restaurant in Stockholm. The suspected vehicle of infection in this outbreak was beansprouts. Between April and June an outbreak of S.Give was identified with cases having a geographical spread over the entire country. A case-control study was undertaken but no food item identified as the potential cause of the outbreak. The outbreak ended with over 50 reported cases.

National evaluation of the recent situation, the trends and sources of infection

The number of domestic cases has increased on 2005 but is within the range of total numbers of domestic cases reported in the last 10 years. Food and water are the most commonly cited sources of infections at the clinical reports.

Relevance as zoonotic disease

There is a very low risk of contracting domestic salmonellosis. As Swedish red and white meat basically is free from Salmonella, it may be considered that the vast majority of cases are due to consumption of imported contaminated food, contact with reptiles and turtles and some secondary cases to imported cases.

2.1.3. Salmonella in foodstuffs

A. Salmonella spp. in eggs and egg products

Monitoring system

Sampling strategy

The salmonella control of table eggs is based on control of all commercial egg laying flocks from establishments placing table eggs on the market and all commercial egg laying flocks of more than 200 hens from establishments not placing table eggs on the market.
There is no control programme for packing centers or for eggs at retail.

B. Salmonella spp. in broiler meat and products thereof

Monitoring system

Sampling strategy

At slaughterhouse and cutting plant

The Swedish Salmonella control programme:
Sampling strategies are described in the Swedish Salmonella control programme approved by teh EU (95/ 50/ EC). The programme is supervised by the SJV and the SLV, and sampling in the programme by the competent authority, that is official veterinarians. They are responsible for the sampling in the herds, flocks, hatcheries, cuttingplants and in the slaughter houses.
Within the programme, neck skin samples at slaughter and crushed meat from equipment etc in cutting plants are collected.
Sampling of necks skin:
Slaughter houses are divided into two categories A and B. Category A slaughter houses annually slaughter 150 000 to 15 000 000 birds, Category B slaughter houses slaughter < 150 000 birds annually. The sampling frame is all poultry slaughtered in Sweden. Enough samples are taken to detect a prevalence of 0.1% Salmonella.
Sampling in Category A: Enough samples are collected at each slaughter house to detect a prevalence of at least 5%. A systematic sampling is performed and samples are collected daily.
Sampling in Category B: Enough samples are collected to detect a prevalence of 5% Salmonella. Samples are evenly spread over the slaughtering days.
Cutting plants:
The control programme is based on production hygiene. The sampling sheme is designed to detect a prevalence of 5% with a confidence level of 95%.

At meat processing plant

According to in-house control plans and decisions by the competent authority.

At retail

According to in-house control plans and decisions by the competent authority.

Frequency of the sampling

At slaughterhouse and cutting plant

Other: Category A: daily; Category B: spread out evenly over the year; cutting plants: once/ day in plants producing >100 tons/ week, once/ week in plants producing >20 tons/ week, once/ month in plants producing >5 tons/ week, twice/ year in plants producing <5 tons/ week.

At retail

Other: decided by the local authorities

Type of specimen taken

At slaughterhouse and cutting plant

Other: Neck skin samples at slaughter houses. Crushed meat from equipment etc or from trimmings at cutting plants.

At meat processing plant

Other: According to in-house control plans and decisions by the competent authority.

At retail

Other: According to in-house control plans and decisions by the competent authority.

Methods of sampling (description of sampling techniques)

At slaughterhouse and cutting plant

At slaughterhouse: 10 neckskin samples are pooled and analyzed as 1 sample. From 10 carcasses at least 10g, approx. 3 x 3 cm of neck skin is cut off and put into a plastic bag. Each sample shall be marked with the cathegory of poultry, identity of the flock, slaughterhouse, time and date of the sampling and stored individually at 4 C until it is sent to the laboratory. At the lab; Each neckskin is divided into two equal parts. One part is pooled. The other part is separatly stored until the examination is completed. One pool may consist of neck-skin from 10-15 birds. The pooled sample is mixed well and pre-enriched in buffered peptone water and examined for salmonella according to NMKL. If salmonella is isolated from a pooled sample each individually stored neck-skin are examined.
Crushed meat: Each sample of 25 g of crushed meat from equipment etc or from trimmings is individually analysed according to NMKL.

Definition of positive finding

At slaughterhouse and cutting plant

A confirmed positive sample.

At meat processing plant

A confirmed positive sample.

At retail

A confirmed positive sample.

Diagnostic/ analytical methods used

At slaughterhouse and cutting plant

Bacteriological method: NMKL 71, ISO 6579 or any other of the approved methods according to Comm. Decision 2003/ 470

At meat processing plant

Bacteriological method: NMKL 71, ISO 6579 or any other of the approved methods according to Comm. Decision 2003/ 470

At retail

Bacteriological method: NMKL 71, ISO 6579 or any other of the approved methods according to Comm. Decision 2003/ 470

Preventive measures in place

The salmonella control programme. Zero-tolerance for salmonella in processed food as well as in raw products.

Control program/ mechanisms

The control program/ strategies in place

National Salmonella Control Programme (Comm. Decision 95/ 50).

Recent actions taken to control the zoonoses

The prevalence of Salmonella in products of Swedish origin is so low that no special actions have had to be taken for many years.

Measures in case of the positive findings or single cases

All positive findings are followed by corrective actions directed against product and process.
If any serotype of salmonella is found in meat samples, the origin of contamination must be traced back to the slaughter house or holding whenever possible. Effective cleaning and disinfection of the premises and equipment must begin in the establishment immediately. This also shall be done on suspicion of salmonella contamination.
Following confirmation of the result by the SVA an increased level of sampling is carried out. This involves taking at least 59 samples (each sample consists of 25 gr of meat or 10 gr neck skins) during the next five working days following the confirmation of the result.

Notification system in place

Any positive finding has to be reported to the competent authority.

Results of the investigation

Salmonella prevalence in animal products of Swedish origin is very low. The local municipalities reported 74 samples from broiler meat or products thereof. All of these were negative for salmonella.
From Cat A slaughter houses 3340 neck skins were analysed and 29 from Cat B slaughter houses. 4 samples were positive: 3 S. Agona and 1 S. Rubislaw.
At cutting plants 1 047 samples were collected. All these samples were negative.

National evaluation of the recent situation, the trends and sources of infection

Salmonella prevalence in animal products of Swedish origin is very low (see "additional information"). Regarding poultry meat and products thereof, reports from the local authorities vary greatly between years. The number of samples as well as the number and percentage of positive samples differ to a large extent from year to year. These variations are explained by factors such as varying degree of reporting, specíal projects that are reported for a special year, special focus on imported products etc. The reports from the local authorities must therefore not be taken too seriously and they are not statistically representative for the country.
The most worrying factor at present is salmonella-positive consignments from other member states that enter the country. This is true not only for meat-preparations but also for consignments covered by the salmonella guarantees.
It should be mentioned that at present 40 % of poultry meat preparations on the market are of foreign origin and for these products there are no Salmonella guarantees.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Swedish produced red and white meat, and eggs virtually are free from salmonella, the risk of contracting salmonella from domestic produced animal products is small.

Additional information

In the surveillance described in the salmonella control programme, approximately 4000 neck skin sample from the slaughter houses are analysed yearly. Between 1995 and 2006, 45637 neck skin samples were collected and of those, 15 (0.03%) were positive.

C. Salmonella spp. in turkey meat and products thereof

Monitoring system

Sampling strategy

At slaughterhouse and cutting plant

Turkey production is included in the Swedish Salmonella control programme and the same applies for turkeys as for broilers.
However the turkey production in Sweden is very small and the reports from the salmonella control do not distinguish between turkeys and broilers. The turkeys are thus included in the figures reported for broilers. They represent a very small part of

the numbers reported.
Even so no Salmonella was found in turkey neck-skins or at cutting plants.

D. Salmonella spp. in pig meat and products thereof

Monitoring system

Sampling strategy

At slaughterhouse and cutting plant

Sampling strategies are described in the Swedish Salmonella control programme approved by EU (95/ 50/ EC). The programmes are supervised by the SJV and the SLV. All sampling in the control programme is supervised by the competent authority, that is official veterinarians. They are responsible for the sampling in the herds, flocks, hatcheries, cuttingplants and in the slaughter houses.
Within the programme, lymph nodes and carcass swabs are systematicly collected from pigs at slaughter to ensure that the samples are representative of the population of slaughtered pigs at each slaughterhouse. Sampling of lymph nodes is described under "Salmonella in pigs".
Slaughter houses have been divided into two categories: Category A slaughtering 90% of all pigs and Category B slaughtering 10% of all pigs.
Category A: At each slaughterhouse a sufficient number of samples is collected to detect at least 5% salmonella infected/ contaminated carcases with 95% confidence interval (CI) in the annual slaughter. Sampling is performed daily in Category A. Samples are collected evenly distributed over the day and if slaughter is performed on separate lines, each will be sampled separately.
Category B: These slaughterhouses are controlled as one unit. Enough samples to detect a prevalence of 1% salmonella infected carcases with 90% CI will be taken. Sampling wil be spread out over the slaughter days to avoid periodical sampling.
Carcass swabs are sampled as a quantitative monitoring of the slaughter hygiene at normal slaughter. The sample size will detect a prevalence of salmonella contaminated carcases of 0.1% with a 95% confidence interval.
Cutting plants: sampling is designed to detect a prevalence of 5% salmonella (95% CI). Samples are taken from crushed meat on equipment etc. or from trimmings.

At meat processing plant

Sampling is according to each plants in-house control.

At retail

Random sampling according to the local competent authorities.

Frequency of the sampling

At slaughterhouse and cutting plant

Other: Carcass swabs: representative sampling spread out evenly over the year; cutting plants: once/ day in plants producing >100 tons/ week, once/ week in plants producing

>20 tons/ week, once/ month in plants producing >5 tons/ week, twice/ year in plants producing <5 tons/ week.

At meat processing plant

Other: According to each in-house control plan and decisions by the competent authority.

At retail

Other: According to in-house control plans and decisions by the competent authority.

Type of specimen taken

At slaughterhouse and cutting plant

Other: Carcass swabs: Approx. 1400 square cm/ carcass is swabbed. Cuttingplants: crushed meat

At meat processing plant

Other: Varies according to in-house control plan and decisions by the local inspector.

At retail

Other: Varies according to in-house control plan and decisions by the local inspector.

Methods of sampling (description of sampling techniques)

At slaughterhouse and cutting plant

Carcass swabs: The carcasses are sampled before the carcass is refrigerated. The upper inner part of the hind legs including the pelvic entrance will be tested. A total of 30 cm x 20-25 cm will be swabbed. The cut surface area of the abdomen and the chest including approximately 5 cm of the skin surface will be tested. Approx. 70-80 cm x 8-10 cm will be swabbed. In total approx 1400 cm2 will be swabbed. Two sterile swabs moistured with PBS are used. The swabs from one carcass wil be place in a plastic bag in 100 ml of PBS. Samples are kept refrigerated until they are sent to the laboratory.
To each sample of two swabs 100 ml of buffered peptone water is added. The sample is incubated overnight. One drop off pre-enrichment broth from each of 10 to 15 animals is pooled in RV broth and examined according to NMKL. Each pre-enrichment broth is stored at 4o C until results are ready. In case of a positive result each broth will be analysed separately.
Crushed meat: each sample of 25 g is individually analysed according to NMKL.

At meat processing plant

According to in-house control plans and decisions by the competent authority.

At retail

According to in-house control plans and decisions by the competent authority.

Definition of positive finding

At slaughterhouse and cutting plant

A confirmed positive sample.

At meat processing plant

A confirmed positive sample.

At retail

A confirmed positive sample.

Diagnostic/ analytical methods used

At slaughterhouse and cutting plant

Bacteriological method: NMKL 71, ISO 6579 or any other of the approved methods according to Comm. Decision 2003/ 470

At meat processing plant

Bacteriological method: NMKL 71, ISO 6579 or any other of the approved methods according to Comm. Decision 2003/ 470

At retail

Bacteriological method: NMKL 71, ISO 6579 or any other of the approved methods according to Comm. Decision 2003/ 470

Preventive measures in place

The salmonella control programme. Zero-tolerance for salmonella in processed food as well as in raw products.

Control program/ mechanisms

The control program/ strategies in place

National Salmonella Control Programme (Comm. Decision 95/ 50). See "Salmonella spp. in pigs".

Recent actions taken to control the zoonoses

The prevalence of Salmonella in products of Swedish origin is so low that no special actions have had to be taken for many years.

Measures in case of the positive findings or single cases

All positive findings are followed by corrective actions directed against product and process.
If salmonella is isolated from a lymph node, trace-back investigation is always performed at the farm

of origin. If salmonella is re-isolated at the farm, measures described in section "Salmonella spp. in pigs" are implemented.

Notification system in place

Any positive finding has to be reported to the competent authority.

Results of the investigation

Salmonella prevalence in animal products of Swedish origin is very low. Results from sampling of fresh meat or meat products from cattle and pig are reported under "Salmonella spp in bovine meat and produvts thereof".
Also, 5918 carcass swabs from pigs (2767 from breeding pigs and 3151 from fattening pigs) were analysed. All of these samples were negative.
From cutting plants, 3898 samples from both cattle and pigs were collected, all but one were negative. The positive sample was from bovine meat. In the total number reported from cutting plants species are not differentiated.

National evaluation of the recent situation, the trends and sources of infection

Salmonella prevalence in animal products of Swedish origin is very low (see "additional information").
The most worrying factor at present is salmonella-positive consignments from other MS that enter the country. This is true not only for meat-preparations but also for consignments covered by the salmonella guarantees.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Swedish red and white meat, and eggs, virtually are free from Salmonella the risk of contracting salmonella from domestically produced food is very small.

Additional information

Between 1996 and 2006, 63 095 lymph nodes from fattening- and adult pigs have been sampled in total. Of those, 81 (0.1%) were positive for salmonella. Similarly, 63 118 swabs have been analysed and of those 7 (0.01%)have been positive. Furthermore, only in a few cases when salmonella were isolated from lymph nodes or swabs was salmonella re-isolated at farm level.

E. Salmonella spp. in bovine meat and products thereof

Monitoring system

Sampling strategy

At slaughterhouse and cutting plant

Sampling strategies are described in the Swedish Salmonella control programme (95/ 50/ EC). The programmes are supervised by the SJV and the SLV and All sampling is supervised by the competent authority, that is the official veterinarian. Official veterinarians are responsible for the sampling in the herds, flocks, hatcheries,

cuttingplants and in the slaughter houses.
Within the programme, lymph nodes and carcass swabs are systematicly collected from cattle at slaughter to ensure that the samples are representative of the population of slaughtered cattle at each slaughterhouse. Description of sampling of lymph nodes is presented under "Salmonella spp. in bovines".
Slaughter houses: Slaughter houses have been divided into two categories. Category A slaughtering 90% of all cattle and category B slaughtering 10% of all cattle.
Cat.A: At each slaughterhouse a sufficient number of samples is collected to detect at least 5% salmonella infected/ contaminated carcases with 95% Confidence Interval (CI) in the annual slaughter. At these slaughter houses samples are collected evenly distributed over the day and if slaughter is performed on separate lines, each will be sampled separately.
Cat.B: These slaughterhouses are controlled as one unit. Enough samples to detect a prevalence of 1% salmonella- infected carcases with 90% CI will be taken. Sampling is spread out over the slaughter days to avoid periodical sampling.
Carcass swabs are collected as a quantitative monitoring of the slaughter hygiene at normal slaughter. The sample size will detect a prevalence of salmonella contaminated carcases of 0.1 % with 95% CI. Samples consist of carcass swabs.
Cutting plants: sampling is designed to detect a prevalence of 5% salmonella (95% CI). Samples are taken from crushed meat on equipment etc. or from trimmings.

At meat processing plant

Sampling is according to each plants in-house control.

At retail

Random sampling according to the local competent authorities.

Frequency of the sampling

At meat processing plant

Other: According to each in-house control plan and decisions by the competent authority.

At retail

Other: According to in–house control plans and decisions by the competent authority.

Type of specimen taken

At slaughterhouse and cutting plant

Other: carcass swabs: aprrox.1400 square cm/ carcass, cuttingplants: crushed meat

At meat processing plant

Other: Varies according to in-house control plan and decisions by the local inspector.

At retail

Other: Varies according to in-house control plan and decisions by the local inspector.

Methods of sampling (description of sampling techniques)

At slaughterhouse and cutting plant

Carcass swabs: The carcasses are sampled before the carcass is refrigerated.
The upper inner part of the hind legs including the pelvic entrance will be tested. A total of 30x20-25 cm will be swabbed. The cut surface area of the abdomen and the chest including approximately 5 cm of the skin surface will be tested. Approx. 70-80 cm x 8-10 cm will be swabbed. In total approx 1400 cm2 will be swabbed. Two sterile swabs moistured with PBS are used. The swabs from one carcass will be placed in a plastic bag in 100 ml of PBS. Samples are kept refrigerated until they are sent to the laboratory.
To each sample of two swabs 100 ml of buffered peptone water is added. The sample is incubated overnight. One drop of pre-enrichment broth from each of 10 to 15 animals is pooled in RV broth and examined according to NMKL. Each pre-enrichment broth is stored at 4o C until results are ready. In case of a positive result each broth will be analysed separately.
Crushed meat: each sample of 25 g is individually analysed according to NMKL.

At meat processing plant

According to in-house control plans and decisions by the competent authority.

At retail

According to in-house control plans and decisions by the competent authority.

Definition of positive finding

At slaughterhouse and cutting plant

A confirmed positive sample.

At meat processing plant

A confirmed positive sample.

At retail

A confirmed positive sample.

Diagnostic/ analytical methods used

At slaughterhouse and cutting plant

Bacteriological method: NMKL 71, ISO 6579 or any other of the approved methods according to Comm. Decision 2003/ 470

At meat processing plant

Bacteriological method: NMKL 71, ISO 6579 or any other of the approved methods

according to Comm. Decision 2003/ 470

At retail

Bacteriological method: NMKL 71, ISO 6579 or any other of the approved methods according to Comm. Decision 2003/ 470

Preventive measures in place

The salmonella control programme. Zero-tolerance for salmonella in processed food as well as in raw products.

Control program/ mechanisms

The control program/ strategies in place

National Salmonella Control Programme (Comm. Decision 95/ 50). See "Salmonella spp in bovine animals".

Recent actions taken to control the zoonoses

The prevalence of Salmonella in products of domestic origin is so low that no special actions have had to be taken for many years.

Measures in case of the positive findings or single cases

All positive findings are followed by corrective actions directed against product and process.
If salmonella is isolated from a lymph node trace-back investigation is always performed at the farm of origin. If salmonella is re-isolated at the farm, measures described in section "Salmonella in bovine animals" are implemented.

Notification system in place

Any positive finding has to be reported to the competent authority.

Results of the investigation

Salmonella prevalence in animal products of Swedish origin is very low. At retail, 771 samples from fresh meat or meat products (including pork and pork products) were reported from the local municipalities, none of these were positive.
In the surveillance in the control programme 3510 carcass swabs were analysed. Of those, 1 was positive (S. Typhimurium DT 104).
From cutting plants, 3898 samples from both cattle and pigs were analysed, one beef sample was positive (S. Typhimurium). Animal species are not distinguished in the reports from the cutting plants.

National evaluation of the recent situation, the trends and sources of infection

Salmonella prevalence in animal products of Swedish origin is very low (see "additional information"). The most worrying factor at present is salmonella-positive consignments from other MS that enter the country. This is true not only for meat-preparations but also for consignments covered by the salmonella guarantees.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Swedish red and white meat, and eggs, are virtually free from Salmonella the risk of contracting salmonella from Swedish produced food is small.

Additional information

Between 1996 and 2006, 35287 lymph nodes from cattle have been sampled in total. Of those, 23 (0.06%) were positive for salmonella. Furthermore, 35301 swabs have been analysed and of those 8 (0,02%) have been positive. Furthermore, only in a few cases when salmonella was isolated from lymph nodes or swabs the same serotype was isolated at farm level leading to restrictions on the farm.

Other food products analysed for salmonella in 2006 and reported by local competent authorities:
The local municipalities reported 1774 samples of ready-to-eat foods, all but one negative. In herbs and spices, 23 reported samples were all negative. One out of 233 fruits and vegetables was positive. One out of 60 samples of crustaceans was Salmonella positive. Finally, 28 samples from table eggs at retail and 151 fishery products were negative for Salmonella. It should be observed that the reporting from the local authorities is far from complete.

Table Salmonella in poultry meat and products thereof

	Source of information	Sampling unit	Sample weight	Units tested	Total units positive for Salmonella spp.	S. Enteritidis	S. Typhimurium	Salmonella spp., unspecified	S. Agona	S. Rubislaw
Meat from broilers (Gallus gallus)										
fresh (1)	local health authority	single	25 g	74	0					
- at cutting plant - domestic production - Control or eradication programmes - national programmes (no Community co-financing) - official sampling - objective sampling	SLV	single	25g	1047	0					
carcass										
- at slaughterhouse - animal sample - neck skin - Control or eradication programmes - national programmes (no Community co-financing) - official sampling - objective sampling (2)	SLV	single	25g	3369	4				3	1

(1) : broiler meat or products thereof
(2) : Slaughterhouse contamination.

Footnote

Samples are neckskin samples taken at the abattoirs and meat trimmings from cutting plants. Turkeys are included in the figures but represent only a very small portion.

Table Salmonella in red meat and products thereof

	Source of information	Sampling unit	Sample weight	Units tested	Total units positive for Salmonella spp.	S. Enteritidis	S. Typhimurium	Salmonella spp., unspecified
Meat from pig								
fresh (1)	reports from local authorities	single	25g	432	0			
meat products								
raw but intended to be eaten cooked (2)	reports from local authorities	single	25g	339	0			
Meat from bovine animals								
fresh	see footnote							
meat products								
raw but intended to be eaten cooked	see footnote							
Meat from bovine animals and pig								
fresh								
- Control or eradication programmes - national programmes (no Community co-financing) - official sampling - objective sampling		single	25 g	3898	1		1	

(1) : include meat from cattle and pig
(2) : include meat from cattle and pig

Footnote

The data given for both meat and meat products include both pigs and cattle. Thr reports do not separate the two species and do not specify if the meat is minced or not. regarding samples within the Swedish Salmonella control Programme - see text file.

Table Salmonella in other food

	Source of information	Sampling unit	Sample weight	Units tested	Total units positive for Salmonella spp.	S. Enteritidis	S. Typhimurium	Salmonella spp., unspecified
Eggs								
table eggs								
- at retail	local health authority	single	25 g	28	0			
Fishery products	local health authority	single	25 g	108	0			
Crustaceans	local health authority	single	25 g	60	1			
Fruits and vegetables	local health authority	single	25 g	233	1			
Other processed food products and prepared dishes								
unspecified								
ready-to-eat foods	local health authority	single	25 g	1774	1			
Spices and herbs	local health authority	single	25 g	23	0			

Footnote

The local health authorities do not report serotypes.

2.1.4. Salmonella in animals

A. Salmonella spp. in Gallus gallus - breeding flocks for egg production and flocks of laying hens

Monitoring system

Sampling strategy

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Sampling strategies are outlined in the Swedish Salmonella control programme, approved by the EU in 1995 (95/ 50/ EC). The salmonella control programme is supervised by the SJV and the SLV.
All sampling performed according to the salmonella programme is supervised by the competent authority. Official veterinarians are responsible for sampling in holdings, hatcheries, cuttingplants and slaughterhouses. Samples are either taken by the official veterinarian or under his/ her supervision if sampling is delegated to farmers/ companies.
The control constitutes of clinical surveillance and sampling. The clinical surveillance include general surveillance and surveillance related to the control programme where an official veterinarian visits breeding establishments every 8 week, laying hen farms once a year and meat producing poultry farm twice a year as required according to the control programme. In the sampling, all categories of poultry are included for bacteriological examination.
Breeders and hatchery:
Sampling of breeding flocks is carried out according to the former Council Directive 92/ 117/ EEC now replaced by Regulation 2160/ 2003/ EEC.
Elite and Grand Parent: samples are taken on 5 separate occasions during rearing. Tissue samples from dead chicks and chicken box linings are taken as a supplement to the faecal sampling. During egg production faecal samples are taken from the breeders themselves every month as a supplement to the sampling in the hatchery.
The parent generation is tested at 3 occasions during the rearing period through tissue sampling as well as faecal sampling. During eggproduction samples are taken from the breeders themselves every month as a supplement to the sampling in the hatchery.

Laying hens flocks

See "Breeding flocks"
Pullets and layers for table egg production:
Sampling of laying flocks with more than 200 layers from establishments not placing eggs on the market and of laying flocks from establishments placing their eggs on the market is carried out as faecal samples. Sampling methods are sufficient to demonstrate freedom within a flock at a confidence level of 95%, if the estimated prevalence of salmonella is 5%.
Egg laying flocks are tested as day-old chicks and once during the rearing period two weeks before moving to a laying unit. The result of this examination must be known

before moving the birds. During the laying phase egg laying flocks are sampled three times: 25-30 weeks old, 50 weeks of age and 3-4 weeks before slaughter. The delay between the last sample and slaughter is made in order to be able to take appropriate measures at slaughter if salmonella is found. Today this last sample is taken not more than 10 days before slaughter due to demands from the slaughterhouse. The result of the last examination must be notified to the poultry meat inspection veterinarian before sending the flock to the slaughterhouse.

Frequency of the sampling

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Other: see 'rearing period'

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Other: GP - as dayold, 1-2weeks, 4 weeks, 9-11weeks and 2 weeks before moving P - day-old, 4 weeks and 2 weeks before moving

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Other: Once a month in the holding and every flock (batch) every 14 days at the hatchery

Laying hens: Day-old chicks

Every flock is sampled

Laying hens: Rearing period

2 weeks prior to moving

Laying hens: Production period

Other: at 25-30 weeks, at 50 weeks and 3-4 weeks before slaughter

Laying hens: Before slaughter at farm

3-4 weeks prior to slaughter

Laying hens: At slaughter

Other: see Salmonella in broiler meat and products thereof

Type of specimen taken

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Other: ceacum from dead chickens, chicken box lining and meconium at the hatchery

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Other: ceacal and faecal samples

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Faeces

Laying hens: Day-old chicks

Other: ceacum from dead chickens, chicken box lining and meconium at the hatchery

Laying hens: Rearing period

Faeces

Laying hens: Production period

Faeces

Laying hens: Before slaughter at farm

Faeces

Laying hens: At slaughter

Other: neck skin, see Salmonella in broiler meat and products thereof

Methods of sampling (description of sampling techniques)

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Chicken box lining:
The lining from chicken boxes are cut into smaller pieces and put into plastic bags. The lining from at most five boxes may be put into one bag as one pooled sample. The plastic bag shall be marked and sent to the laboratory the same day.
The pooled sample is cut into smaller pieces and mixed well. At least 25 g material is examined for Salmonella according to Nordic Committee on Food Analysis.
Dead birds:
Ceaca from 10 animals are taken out and pooled into one stomacher bag (one pooled sample). The stomacher bag shall be marked and sent to the laboratory the same day.
The pooled sample is homogenized in a stomacher. If the sample comes from day old chickens, at least 10g material shall be examined. If the samples comes from older birds, at least 25g material shall be examined. All samples are examined for Salmonella according to Nordic Committee on Food Analysis.
Meconium:
Meconium from 250 newly hatched chickens are collected and put in a stomacher bag. The bag is marked and sent to the laboratory the same day. The pooled sample is homogenized in a stomacher. At least 30g material is analyzed for Salmonella

according to Nordic Committee on Food Analysis.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

From each epidemiological unit; 60g(30gx2)fresh faecal material and, 10 ceaca pooled into 1 sample.
Dead birds:
Caeca from at most 10 animals are taken out and pooled into one stomacher bag (one pooled sample). The stomacher bag shall be marked and sent to the laboratory the same day. The pooled sample is homogenized in a stomacher. If the sample comes from day old chickens, at least 10g material shall be examined. If the samples comes from older birds, at least 25g material shall be examined. All samples are examined for Salmonella according to Nordic Committee on Food Analysis.
Faecal samples:
One pooled sample consists of droppings from 30 birds. From each individual at least 1g faeces is collected and put in a stomacher bag. The bag is marked and sent to the laboratory the same day. The sample is examined for Salmonella according to Nordic Committee on Food Analysis.

Breeding flocks: Production period

60g (30gx2) fresh faecal material collected in the flock and pooled meconium from 250 newly hatched chicks from each flock every 14 day at the hatchery

Laying hens: Day-old chicks

see "Breeding flocks: Day-old chicks"

Laying hens: Rearing period

Fresh droppings from 90 pullets at different locations within the unit. Each pooled sample consists of 30g.

Laying hens: Production period

90g fresh faecal material pooled into 30gx3 or in case of free range indoors or if a flock consists of <1000 hens - 30gx2 (60g)

Laying hens: Before slaughter at farm

30gx3(90g) or 30x2(60g) fresh faecal droppings

Laying hens: At slaughter

see "Salmonella in broiler meat and products thereof"

Case definition

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

If salmonella is isolated from an individual animal, the whole flock is considered infected with salmonella. In poultry, the flock is the epidemiological unit.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

See "Breeding flocks: Day-old chicks"

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

See "Breeding flocks: Day-old chicks"

Laying hens: Day-old chicks

See "Breeding flocks: Day-old chicks"

Laying hens: Rearing period

See "Breeding flocks: Day-old chicks"

Laying hens: Production period

See "Breeding flocks: Day-old chicks"

Laying hens: Before slaughter at farm

See "Breeding flocks: Day-old chicks"

Laying hens: At slaughter

The pooled neckskin sample is traced back to the farm of origin. The farm is put under restrictions and an official veterinarian is assigned for official sampling. If these are negative - no further measures. If positive - the farm (or only the epidemiological unit if there are more than one separate units at the holding) is considered infected.

Diagnostic/ analytical methods used

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Bacteriological method: NMKL No 71:1999

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Bacteriological method: NMKL No 71:1999

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Bacteriological method: NMKL No 71:1999

Laying hens: Day-old chicks

Bacteriological method: NMKL No 71:1999

Laying hens: Rearing period

Bacteriological method: NMKL No 71:1999

Laying hens: Production period

Bacteriological method: NMKL No 71:1999

Laying hens: Before slaughter at farm

Bacteriological method: NMKL No 71:1999

Laying hens: At slaughter

Bacteriological method: NMKL No 71:1999

Vaccination policy

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Vaccination against salmonellosis is not allowed in poultry.

Laying hens flocks

See "Breeding flocks"

Other preventive measures than vaccination in place

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

In food-producing animals salmonella control in feed- and feed production (HACCP based approach) is integrated in the salmonella control.
Strict hygiene rules are enforced through the whole production chain as preventive measures for salmonella. These rules are implemented by the Prophylactic volontary salmonella control programme and includes: a)Rules for feed production and transport, b) hygienic rules to protect the birds from salmonella infection from the surroundings, c) salmonella free newly hatched chickens are delivered from the hatcheries, d) precaution to stop spread of salmonella from an infected flock, and e) all- in - all out principle in all categories of poultry production.

Laying hens flocks

See "Breeding flocks"

Control program/ mechanisms

The control program/ strategies in place

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

In food-producing animals salmonella control in feed- and feed production (HACCP based approach) is integrated in the control.
Sampling strategies are outlined in the Swedish Salmonella control programme, approved by the EU in 1995 (95/ 50/ EC). The control programme for live poultry covers laying hens, broilers, turkeys, ducks and gees from elite flocks to commercial stock. Other species of live poultry as defined in article 2 (1) of the Council Directive 90/ 539/ EEC are excluded from this control programme. All serotypes of salmonella are covered.
The control consitutes of clinical surveillance and sampling. The clinical surveillance inlcude general surveillance and surveillance related to the control programme. The official veterinarian visits every poultry holding with breeders, layers and meat production establishment as required according to the control programme. All categories of poultry are sampled for bacteriological examination as described above.

Laying hens flocks

See "Breeding flocks"

Measures in case of the positive findings or single cases

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

The infected farm is put under restriction and the flock is culled and either sent for destruction (in case of invasive serotype) or heat-treated (the latter is never practised in Sweden). An investigation in order to trace the source of infection is conducted by the official veterinarian. The premises/ contaminated houses are cleaned and disinfected and manure and feeding stuffs left on the farm are destroyed or decontaminated. Restrictions are not lifted until environmental samples from within the house are taken and analyzed with negative results.

Laying hens flocks

See "Breeding flocks"
In laying hens flocks, finding of invasive salmonella serotype results in destruction of the flock and all eggs in storage.
Finding of non invasive salmonella serotypes results in destruction or sanitary slaughter of the flock. In those cases: a)The meat may be used for human consumption after heat treatment in the processing plant. b)Eggs from a flock infected with non invasive salmonella may be used for human consumption after pasteurization. However,this is not practised in Sweden.

Notification system in place

All findings of salmonella is compulsory notifiable. The obligation to notify all salmonella findings has been in force since 1961.

Results of the investigation

One flock of laying hens was infected with S. Typhimurium during rearing period. No Salmonella was isolated in breeding flocks.
Results from sampling of neck skins and crushed meat in the control programme is presented under the section "Salmonella in broiler meat and products thereof".

National evaluation of the recent situation, the trends and sources of infection

Since 1996, the situation has remained stable with only 3 to 4 infected flocks per year. The favourable situation is also reflected in the yearly sampling of approximately 4000 neck skin samples at the slaughter houses. Between 1995 and 2006, 45 608 neck skin samples were collected and of those, 16 (0.04%) were positive.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Swedish produced red and white meat, and eggs virtually are free from salmonella, the risk of contracting salmonella from domestic produced food of animal origin is very small.

Additional information

In poultry, the flock is the epidemiological unit. This is important concerning breeders as several flocks may be raised in seperate units in the holding at the same. Measures, in case of positive findings, are taken at each epidemiological unit since the strict hygiene rules that are implemented according to the Swedish Salmonella control programme makes it possible to define the flocks as strictly seperated units.

B. Salmonella spp. in Gallus gallus - breeding flocks for meat production and broiler flocks

Monitoring system

Sampling strategy

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Sampling strategies are outlined in the Swedish Salmonella control programme, approved by the EU in 1995 (95/ 50/ EC). The salmonella control programme is supervised by the SJV and the SLV.
All sampling performed according to the salmonella programme is supervised by the competent authority. Official veterinarians are responsible for sampling in holdings, hatcheries, cuttingplants and slaughterhouses. Samples are either taken by the official veterinarian or under his/ her supervision if sampling is delegated to farmers/ companies.
The control constitutes of clinical surveillance and sampling. The clinical surveillance includes general surveillance and surveillance related to the control programme where an official veterinarian visits breeding establishments every 8 week and meat producing poultry farms twice a year as required according to the control programme. In the sampling, all categories of poultry are included for bacteriological examination. The aim is to detect a prevalence of salmonella of at least 5% with a confidence interval of 95% on flock level each time sampling is done.
Breeders and hatchery:
Sampling of breeding flocks is carried out according to the former Council Directive 92/ 117/ EEC now replaced by Regulation 2160/ 2003/ EEC.

There are no broiler Elite flocks in Sweden.
Grand Parent:
Samples are taken on 5 separate occasions during rearing. Tissue samples from dead chicken and chicken box linings are taken as a supplement to the faecal sampling. During egg production faecal samples are taken from the breeders themselves every month as a supplement to the sampling in the hatchery.
The parent generation is tested at 3 occasions during the rearing period through tissue sampling as well as faecal sampling. During egg production samples are taken from the breeders themselves every month as a supplement to the sampling in the hatchery.

Broiler flocks

All commercial meat-producing establishments have an official veterinarian assigned for salmonella control. The veterinarian is usually employed by the National Food Administration and stationed at the slaughterhouse where the flock is destined for slaughter. The veterinarian visits the farm at least twice a year for supervision and sampling.
Every flock is sampled 1-2 weeks prior to slaughter either by the veterinarian or by the farmer if sampling is delegated. The result must be notified to the veterinarian before sending the flock to the slaughterhouse.

Frequency of the sampling

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Other: see "rearing period"

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Other: GP - as day-old, 1-2 weeks, 4 weeks, 9-11 weeks and 2 weeks prior to moving, P - day-old, 4 weeks and 2 weeks prior to moving

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Once a month

Broiler flocks: Day-old chicks

Every flock is sampled

Broiler flocks: Rearing period

1-2 weeks prior to slaughter

Broiler flocks: Before slaughter at farm

1-2 weeks prior to slaughter

Broiler flocks: At slaughter (flock based approach)

Other: see Salmonella in broiler meat and products thereof

Type of specimen taken

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Other: ceaca from dead birds, chicken box lining and meconium

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Other: ceacal and faecal material

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Faeces

Broiler flocks: Day-old chicks

Other: ceaca from dead birds, chicken box lining and meconium

Broiler flocks: Before slaughter at farm

Other: faecal and organs

Broiler flocks: At slaughter (flock based approach)

Other: neck skins, see Salmonella in broiler meat and products thereof

Methods of sampling (description of sampling techniques)

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Chicken box lining:
The lining from chicken boxes are cut into smaller pieces and put into plastic bags. The lining from at most five boxes may be put into one bag as one pooled sample. The plastic bag shall be marked and sent to the laboratory the same day.
The pooled sample is cut into smaller pieces and mixed well. At least 25 g material is examined for Salmonella according to Nordic Committee on Food Analysis.
Dead birds:
Ceaca from 10 animals are taken out and pooled into one stomacher bag (one pooled sample). The stomacher bag shall be marked and sent to the laboratory the same day.
The pooled sample is homogenized in a stomacher. If the sample comes from day old chickens, at least 10g material shall be examined. If the samples comes from older birds, at least 25g material shall be examined. All samples are examined for Salmonella according to Nordic Committee on Food Analysis.
Meconium:

Meconium from 250 newly hatched chickens are collected and put in a stomacher bag. The bag is marked and sent to the laboratory the same day. The pooled sample is homogenized in a stomacher. At least 30g material is analyzed for Salmonella according to Nordic Committee on Food Analysis.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Sampling:
From each epidemiological unit, 60g (30gx2) fresh faecal material and 10 caeca (pooled into 1 sample) are collected.
Faecal samples:
One pooled sample consists of droppings from 30 birds. From each individual at least 1g faeces is collected and put in a stomacher bag. The bag is marked and sent to the laboratory the same day. The sample is examined for Salmonella according to Nordic Committee on Food Analysis.
Dead birds:
See "Breeding flocks: Day-old chicks"

Breeding flocks: Production period

60g (30gx2) fresh faecal material is collected in the flock.
Faecal samples:
See "Breeding flocks: Rearing period"

Broiler flocks: Day-old chicks

Chicken box lining, dead birds, meconium:
See "Breeding flocks: Day-old chicks"

Broiler flocks: Rearing period

no sampling between day-old and pre-slaughter

Broiler flocks: Before slaughter at farm

30g faecal material pooled into 1 sample and 30 caeca pooled 10x3 = 4 analyses
In houses with >2 epidemiological units or <500 birds/ unit; 30gx2 (60g) faecal material and 10 organs pooled to 1 sample is taken
Faecal samples:
See "Breeding flocks: Rearing period"
Caecal sampling:
Caeca from 10 animals are taken out and pooled into one stomacher bag (one pooled sample). The stomacher bag shall be marked and sent to the laboratory the same day. The pooled sample is homogenized in a stomacher. If the sample comes from day old chickens, at least 10g material shall be examined. If the samples come from older birds, at least 25g material shall be examined. All samples are examined for Salmonella according to Nordic Committee on Food Analysis.

Broiler flocks: At slaughter (flock based approach)

see "Salmonella in broiler meat and products thereof"

Case definition

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

If salmonella is isolated from an individual animal, the whole flock is considered salmonella infected. In poultry, the flock is the epidemiological unit.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

See "Breeding flocks: Day-old chicks"

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

See "Breeding flocks: Day-old chicks"

Broiler flocks: Day-old chicks

See "Breeding flocks: Day-old chicks"

Broiler flocks: Rearing period

See "Breeding flocks: Day-old chicks"

Broiler flocks: Before slaughter at farm

See "Breeding flocks: Day-old chicks"

Broiler flocks: At slaughter (flock based approach)

A positive neck skin sample at slaughter initiates an investigation back at the holding of origin. The farm is put under restrictions and official sampling is conducted. If these samples are positive the holding/ flock is considered infected.

Diagnostic/ analytical methods used

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Bacteriological method: NMKL No 71:1999

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Bacteriological method: NMKL No 71:1999

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Bacteriological method: NMKL No 71:1999

Broiler flocks: Day-old chicks

Bacteriological method: NMKL No 71:1999

Broiler flocks: Rearing period

Bacteriological method: NMKL No 71:1999

Broiler flocks: Before slaughter at farm

Bacteriological method: NMKL No 71:1999

Broiler flocks: At slaughter (flock based approach)

Bacteriological method: NMKL No 71:1999

Vaccination policy

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Vaccination against salmonella is not allowed in poultry.

Broiler flocks

See "Breeding flocks"

Other preventive measures than vaccination in place

Broiler flocks

In food-producing animals salmonella control in feed- and feed production (HACCP based approach) is integrated in the salmonella control.
Strict hygiene rules are enforced through the whole production chain as preventive measures for salmonella. These rules are implemented by the Prophylactic volontary salmonella control programme and includes: a)Rules for feed production and transport, b) hygienic rules to protect the birds from salmonella infection from the surroundings, c) salmonella free newly hatched chickens are delivered from the hatcheries, d) precaution to stop spread of salmonella from an infected flock, and e) all- in - all out principle in all categories of poultry production.

Control program/ mechanisms

The control program/ strategies in place

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Sampling strategies are outlined in the Swedish Salmonella control programme, approved by the EU in 1995 (95/ 50/ EC). The control programme for live poultry covers laying hens, broilers, turkeys, ducks and gees from elite flocks to commercial stock. Other species of live poultry as defined in article 2 (1) of the Council Directive 90/ 539/ EEC are excluded from this control programme. All serotypes of salmonella

are covered. The control constitutes of clinical surveillance and sampling. The clinical surveillance includes general surveillance and surveillance related to the control programme. The official veterinarian visits every poultry holding with breeders, layers and meat production establishment as required according to the control programme. All categories of poultry are sampled for bacteriological examination as described above.

Broiler flocks

see "Breeding flocks"

Measures in case of the positive findings or single cases

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

The chicks would be traced, culled and sent for destruction and the premises where the chicks were sent to and the hatchery would be cleaned and disinfected. The farm/ flock of origin is traced and put under restrictions. Official sampling is conducted and if the flock is positive, it is culled and either sent for destruction (in case of invasive serotype) or heat-treated (the latter is never practised in Sweden). An investigation in order to trace the source of infection is conducted by the official veterinarian. The premises/ contaminated houses are cleaned and disinfected and manure and feeding stuffs left on the farm are destroyed or decontaminated. Restrictions are not lifted until environmental samples from within the house are taken and analyzed with negative results.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

The infected farm is put under restriction and the flock is culled and either sent for destruction (in case of an invasive serotype) or heat-treated (the latter is never practised in Sweden). An investigation in order to trace the source of infection and destination of hatching eggs delivered from the holding is conducted by the official veterinarian. The premises/ contaminated houses are cleaned and disinfected and manure and feeding stuffs left on the farm are destroyed or decontaminated. Restrictions are not lifted until environmental samples from within the house are taken and analyzed with negative results.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

See "Breeding flocks: Rearing period"

Broiler flocks: Day-old chicks

See "Breeding flocks: Rearing period"

Broiler flocks: Rearing period

See "Breeding flocks: rearing period"

Broiler flocks: Before slaughter at farm

See "Breeding flocks: rearing period"

Broiler flocks: At slaughter (flock based approach)

see "Salmonella in broiler meat and products thereof"

Notification system in place

All findings of salmonella are compulsory notifiable. The obligation to notify all salmonella findings has been in force since 1961.

Results of the investigation

S. Typhimurium caused an outbreak including 10 flocks in total in December 2006. Most likely the index case was a grand parent flock. The outbreak continued in 2007.
S. Senftenberg was isolated in another grand parent flock.
The results from the surveillance of neck skins are presented un der the section "Salmonella in broiler meat and products thereof".

National evaluation of the recent situation, the trends and sources of infection

Between 1996-2005, the situation was stable with only 1 to 2 infected flocks per year. In 2006 an outbreak increased the number of cases. Between 1995 and 2006, 45 608 neck skin samples were collected and of those 16 (0.04%) were positive.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Swedish produced red and white meat, and eggs virtually are free from salmonella, the risk of contracting salmonella from domestic produced animal products is very small.

Additional information

In poultry, the flock is the epidemiological unit. This is important concerning broilers as several flocks may be raised at the same time in different units within the same house/ holding. When measures are taken in case of positive findings the strict hygiene rules that are implemented according to the Swedish Salmonella control programme makes it possible to define the broiler flock as the epidemiological unit.

C. Salmonella spp. in turkey - breeding flocks and meat production flocks

Monitoring system

Sampling strategy

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Sampling strategies are outlined in the Swedish Salmonella control programme, approved by the EU in 1995 (95/ 50/ EC). The salmonella control programme is supervised by the SJV and the SLV.

All the sampling according to the salmonella programme is supervised by the competent authority. Official veterinarians are responsible for sampling in holdings, hatcheries, cuttingplants and slaughterhouses. Samples are either taken by the official veterinarian or under his/ her supervision if sampling is delegated to farmers/ companies.
The control constitutes of clinical surveillance and sampling. The clinical surveillance includes general surveillance and surveillance related to the control programme where an official veterinarian visits breeding establishments every 8 week, farms with laying hens once a year and meat producing poultry farm twice a year as required according to the control programme. In the sampling, all categories of poultry are included for bacteriological examination. The aim is to detect a prevalence of salmonella of at least 5% with a confidence interval of 95% on flock level each time sampling is done.
Breeders and hatchery:
Sampling of breeding flocks is carried out according to the former Council Directive 92/ 117/ EEC now replaced by Regulation 2160/ 2003/ EEC.
Elite and Grand Parent:
There are no turkey elite or GP breeding flocks in Sweden.
The parent generation is tested at 3 occasions during the rearing period. During eggproduction samples are taken from the breeders themselves every month as a supplement to the sampling in the hatchery.

Meat production flocks

See "Breeding flocks"

Frequency of the sampling

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Other: see 'rearing period'

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Other: P - as day-old, 4 weeks and 2 weeks prior to moving

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Once a month

Meat production flocks: Day-old chicks

Every flock is sampled

Meat production flocks: Before slaughter at farm

1-2 weeks prior to slaughter

Meat production flocks: At slaughter (flock based approach)

Other: see Salmonella in broiler meat and products thereof

Type of specimen taken

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Other: ceaca from dead birds, chicken box lining and meconium

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Other: ceacal and faecal samples

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Other: ceacal and faecal samples

Meat production flocks: Day-old chicks

Meconium

Meat production flocks: Before slaughter at farm

Faeces

Meat production flocks: At slaughter (flock based approach)

Other: neck skin; see Salmonella in broiler meat and products thereof

Methods of sampling (description of sampling techniques)

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Pooled meconium from each flock at the hatchery every 14 day, chicken box linings and dead birds at arrival
Meconium:
Meconium from 250 newly hatched turkeys are collected and put in a stomacher bag. The bag is marked and sent to the laboratory the same day. The pooled sample is homogenized in a stomacher. At least 30g material is analyzed for Salmonella according to Nordic Committee on Food Analysis.
Chicken box lining:
The lining from the boxes are cut into smaller pieces and put into plastic bags. The lining from at most five boxes may be put into one bag as one pooled sample. The plastic bag shall be
marked and sent to the laboratory the same day. The pooled sample is cut into smaller pieces and mixed well. At least 25 g material is examined for Salmonella according to Nordic Committee on Food Analysis.
Dead birds:
Ceaca from 10 animals are taken out and pooled into one stomacher bag (one pooled

sample). The stomacher bag shall be marked and sent to the laboratory the same day. The pooled sample is homogenized in a stomacher. If the sample comes from day old turkeys, at least 10g material shall be examined. If the samples comes from older birds, at least 25g material shall be examined. All samples are examined for Salmonella according to Nordic Committee on Food Analysis.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Dead birds:
"See Breeding flocks: Day-old chicks"
Faecal samples:
One pooled sample consists of droppings from 30 birds. From each individual at least 1g faeces is collected and put in a stomacher bag. The bag is marked and sent to the laboratory the same day.
The sample is examined for Salmonella according to Nordic Committee on Food Analysis.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

See "Breeding flocks: rearing period"

Meat production flocks: Day-old chicks

Chicken box lining:
The lining from chicken boxes are cut into smaller pieces and put into plastic bags. The lining from at most five boxes may be put into one bag as one pooled sample. The plastic bag shall be marked and sent to the laboratory the same day.
The pooled sample is cut into smaller pieces and mixed well. At least 25 g material is examined for Salmonella according to Nordic Committee on Food Analysis.
Meconium:
See "Breeding flocks: Day-old chicks"
Dead birds:
See "Breeding birds: Day-old chicks"

Meat production flocks: Rearing period

no sampling between day-old and pre-slaughter

Meat production flocks: Before slaughter at farm

90g fresh faecal material pooled into 30gx3
Faecal samples:
One pooled sample consists of droppings from 30 birds. From each individual at least 1g faeces is
collected and put in a stomacher bag. The bag is marked and sent to the laboratory the same day.
The sample is examined for Salmonella according to Nordic Committee on Food Analysis.

Meat production flocks: At slaughter (flock based approach)

see Salmonella in broiler meat and products thereof

Case definition

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

If salmonella is isolated from an individual animal, the whole flock is considered salmonella infected. In poultry, the flock is the epidemiological unit.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

See "Breeding flocks: Rearing period"

Meat production flocks: Day-old chicks

See "Breeding flocks: Rearing period"

Meat production flocks: Rearing period

See "Breeding flocks: Rearing period"

Meat production flocks: Before slaughter at farm

See "Breeding flocks: Rearing period"

Meat production flocks: At slaughter (flock based approach)

A positive neck skin sample at slaughter initiates an investigation back at the holding of origin. The farm is put under restrictions and official sampling is conducted. If these samples are positive the holding/ flock is considered infected.

Diagnostic/ analytical methods used

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Bacteriological method: NMKL No 71:1999

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Bacteriological method: NMKL No 71:1999

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Bacteriological method: NMKL No 71:1999

Meat production flocks: Day-old chicks

Bacteriological method: NMKL No 71:1999

Meat production flocks: Rearing period

Bacteriological method: NMKL No 71:1999

Meat production flocks: Before slaughter at farm

Bacteriological method: NMKL No 71:1999

Meat production flocks: At slaughter (flock based approach)

Bacteriological method: NMKL No 71:1999

Case definition

If salmonella is isolated from an individual animal, the whole flock is considered salmonella infected. In poultry, the flock is the epidemiological unit.

Vaccination policy

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Vaccination against salmonellosis is not allowed in poultry.

Meat production flocks

See "Breeding flocks"

Other preventive measures than vaccination in place

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Strict hygiene rules are enforced through the whole production chain as preventive measures for salmonella. These rules are implemented by the Prophylactic volontary salmonella control programme and includes: a)Rules for feed production and transport, b) hygienic rules to protect the birds from salmonella infection from the surroundings, c) salmonella free newly hatched chickens are delivered from the hatcheries, d) precaution to stop spread of salmonella from an infected flock, and e) all- in - all out principle in all categories of poultry production.

Meat production flocks

see "Breeding flocks"

Control program/ mechanisms

The control program/ strategies in place

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Sampling strategies are outlined in the Swedish Salmonella control programme, approved by the EU in 1995 (95/ 50/ EC). The control programme for live poultry covers laying hens, broilers, turkeys, ducks and gees from elite flocks to commercial

stock. Other species of live poultry as defined in article 2 (1) of the Council Directive 90/ 539/ EEC are excluded from this control
programme. All serotypes of salmonella are covered. The control consitutes of clinical surveillance and sampling. The clinical surveillance inlcude general surveillance and surveillance related to the control programme. The official veterinarian
visits every poultry holding with breeders, layers and meat production establishment as required according to the control programme. All categories of poultry are sampled for bacteriological examination as described above.

Meat production flocks

see "Breeding flocks"

Measures in case of the positive findings or single cases

The infected farm is put under restriction and the flock is culled and either sent for destruction (in case of invasive serotype) or heat-treated (the latter is never practised in Sweden). An investigation in order to trace the source of infection is conducted by the official veterinarian. The premises/ contaminated houses are cleaned and disinfected and manure and feeding stuffs left on the farm are destroyed or decontaminated. Restrictions are not lifted until environmental samples from within the house are taken and analyzed with negative results.

Notification system in place

All findings of salmonella is compulsory notifiable. The obligation to notify all salmonella findings has been in force since 1961.

Results of the investigation

No turkey breeders or meat producing flocks were infected with salmonella during 2006.

National evaluation of the recent situation, the trends and sources of infection

Since 1996, the situation has remained stable with none to a few infected flocks per year.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Swedish produced red and white meat, and eggs virtually are free from salmonella, the risk of contracting salmonella from food products of domestic animal origin is very small.

Additional information

In poultry, the flock is the epidemiological unit. This is important also concerning turkey breeders and turkeys for slaughter as several flocks may be raised in seperate units in the house/ holding at the same. Measures, in case of positive findings, are taken at each epidemiological unit since the strict hygiene rules that are implemented according to the Swedish Salmonella control programme makes it possible to define the flocks as strictly separated units.

D. Salmonella spp. in geese - breeding flocks and meat production flocks

Monitoring system

Sampling strategy

Breeding flocks

Sampling strategies are outlined in the Swedish Salmonella control programme, approved by the EU in 1995 (95/ 50/ EC). The salmonella control programme is supervised by the SJV and the SLV.
All sampling according to the salmonella programme is supervised by the competent authority. Official veterinarians are responsible for sampling in holdings, hatcheries, cuttingplants and slaughterhouses. Samples are either taken by the official veterinarian or under his/ her supervision if sampling is delegated to farmers/ companies.
The control constitutes of clinical surveillance and sampling. The clinical surveillance include general surveillance and surveillance related to the control programme where an official veterinarian visits geese breeding establishments every 8 week and meat producing geese farms twice a year as required according to the control programme. In the sampling, all categories of poultry are included for bacteriological examination. The aim is to detect a prevalence of salmonella of at least 5% with a confidence interval of 95% on flock level each time sampling is done.
Breeders and hatchery:
Sampling of breeding flocks is carried out according to the former Council Directive 92/ 117/ EEC now replaced by Regulation 2160/ 2003/ EEC.
There are no geese Elite and Grand Parent stock in Sweden.
The Parent generation is tested at 3 occasions during the rearing period. During eggproduction samples are taken from the breeders themselves every month as a supplement to the sampling in the hatchery.

Type of specimen taken

Imported feed material of animal origin

see "Salmonella spp in feed"

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Other: faecal and ceacal

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Faeces

Meat production flocks: Before slaughter at farm

Faeces

Meat production flocks: At slaughter (flock based approach)

Other: neck skin, see Salmonella in broiler meat and products thereof

Frequency of the sampling

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Other: as dayold, at 4 weeks and 2 weeks prior to moving

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Once a month

Meat production flocks: Before slaughter at farm

1-2 weeks prior to slaughter

Meat production flocks: At slaughter (flock based approach)

Other: see Salmonella in broiler meat and products thereof

Methods of sampling (description of sampling techniques)

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Fresh faecal droppings are collected from 60 geese and the material is divided in 2 samples (30gx2)
Faecal samples:
One pooled sample consists of droppings from 30 birds. From each individual at least 1g faeces is collected and put in a stomacher bag. The bag is marked and sent to the laboratory the same day. The sample is examined for Salmonella according to Nordic Committee on Food Analysis.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

See "Breeding flocks"

Meat production flocks: Before slaughter at farm

60 fresh faecal droppings pooled as 30gx2

Meat production flocks: At slaughter (flock based approach)

see "Salmonella in broiler meat and products thereof"

Case definition

Breeding flocks: Day-old chicks

If salmonella is isolated from an individual animal, the whole flock is considered salmonella infected. In poultry, the flock is the epidemiological unit.

Breeding flocks: Rearing period

See "Breeding flocks: Day-old chicks"

Breeding flocks: Production period

See "Breeding flocks: Day-old chicks"

Meat production flocks: Day-old chicks

See "Breeding flocks: Day-old chicks"

Meat production flocks: Rearing period

See "Breeding flocks: Day-old chicks"

Meat production flocks: Before slaughter at farm

See "Breeding flocks: Day-old chicks"

Meat production flocks: At slaughter (flock based approach)

A positive neck skin sample at slaughter results in restriction on the holding of origin and additional official sampling at the holding. If the official samples are positive the farm is considered infected

Diagnostic/ analytical methods used

Breeding flocks: Day-old chicks

Bacteriological method: NMKL No 71:1999

Breeding flocks: Rearing period

Bacteriological method: NMKL No 71:1999

Breeding flocks: Production period

Bacteriological method: NMKL No 71:1999

Meat production flocks: Day-old chicks

Bacteriological method: NMKL No 71:1999

Meat production flocks: Rearing period

Bacteriological method: NMKL No 71:1999

Meat production flocks: Before slaughter at farm

Bacteriological method: NMKL No 71:1999

Meat production flocks: At slaughter (flock based approach)

Bacteriological method: NMKL No 71:1999

Vaccination policy

Breeding flocks

Vaccination against salmonellosis is not allowed in poultry.

Meat production flocks

See "Breeding flocks"

Other preventive measures than vaccination in place

Breeding flocks

High bio-security rules at the same level as for other breeding stocks. These flocks are raised indoors

Meat production flocks

Controlled feed, salmonella free ducklings

Control program/ mechanisms

The control program/ strategies in place

Breeding flocks

At some breeding establishments where geese are kept indoors the same strict hygiene rules are enforced as in the preventive volontary salmonella control programme even though geese farms
are not accepted within the programme. It includes: a)Rules for feed production and transport, b)hygienic rules to protect the birds from salmonella infection from the surroundings, c) salmonella free newly hatched geeslings are delivered from the hatcheries, d) precaution to stop spread of salmonella from an infected flock, and e) all- in - all out principle in all houses.
At some holdings no preventive measures are applied

Meat production flocks

These are raised out-doors. Following rules are applied at some establishments: a)Rules for feed production and transport, b) salmonella free newly hatched geeslings are delivered from the hatcheries, c)precaution to stop spread of salmonella from an infected flock. At some holdings no preventive measures are applied.

Measures in case of the positive findings or single cases

Breeding flocks

Restrictions to and from the farm, culling of infected animals, destruction, cleaning and disinfection and finally environmental negative samples before restrictions are lifted.

Meat Production flocks

See "Breeding flocks"

Notification system in place

All findings of salmonella is compulsory notifiable. The obligation to notify all salmonella findings has been in force since 1961.

Results of the investigation

Salmonella was not isolated from any holding in 2006.
Results from surveillance of neck skins is presented under the section Salmonella in broiler meat and products thereof.

National evaluation of the recent situation, the trends and sources of infection

Since 1996, the situation has remained stable with no to a few infected flocks per year.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Swedish produced red and white meat, and eggs virtually are free from salmonella, the risk of contracting salmonella from domestic produced animal products is small.

E. Salmonella spp. in ducks - breeding flocks and meat production flocks

Monitoring system

Sampling strategy

Breeding flocks

Sampling strategies are outlined in the Swedish Salmonella control programme, approved by the EU in 1995 (95/ 50/ EC). The salmonella control programme is supervised by the SJV and the SLV.
All sampling according to the salmonella programme is supervised by the competent authority. Official veterinarians are responsible for sampling in holdings, hatcheries, cuttingplants and slaughterhouses. Samples are either taken by the official veterinarian or under his/ her supervision if sampling is delegated to farmers/ companies.
The control constitutes of clinical surveillance and sampling. The clinical surveillance include general surveillance and surveillance related to the control programme where an official veterinarian visits a duck breeding establishments every 8 week and meat producing duck farms twice a year as required according to the control programme. In the sampling, all categories of poultry are included for bacteriological examination. The aim is to detect a prevalence of salmonella of at least 5% with a confidence interval of 95% on flock level each time sampling is done.
Breeders and hatchery:
Sampling of breeding flocks is carried out according to the former Council Directive 92/ 117/ EEC now replaced by Regulation 2160/ 2003/ EEC.
There are no Elite and Grand Parent ducks in Sweden. The breeding stock is imported as Parents.

The parent generation is tested at 3 occasions during the rearing period. During egg production samples are taken from the breeders themselves every month as a supplement to the sampling in the hatchery.

Meat production flocks

Mandatory sampling if >500 ducks are raised for slaughtered/ year.
Every flock is sampled 1-2 weeks prior to slaughter. If thinning is practised additional sampling has to be done efter 10 days. At 2 occasions/ year this sampling is done by an official veterinarian - usually the veterinarian responsible at the slaughterhouse where the ducks are admitted for slaughter.

Frequency of the sampling

Breeding flocks: Production period

Once a month

Meat production flocks: Before slaughter at farm

1-2 weeks prior to slaughter

Meat production flocks: At slaughter (flock based approach)

Other: see Salmonella in broiler meat and products thereof

Type of specimen taken

Breeding flocks: Rearing period

Faeces

Breeding flocks: Production period

Faeces

Meat production flocks: Before slaughter at farm

Faeces

Meat production flocks: At slaughter (flock based approach)

Other: : neck skins, see Salmonella in broiler meat and products thereof

Methods of sampling (description of sampling techniques)

Breeding flocks: Rearing period

Fresh faecal droppings are collected from 60 ducks and the material is divided in 2 samples (30gx2) and 10 ceacal samples pooled into 1 sample.
Faecal samples:
One pooled sample consists of droppings from 30 birds. From each individual at least 1g faeces is collected and put in a stomacher bag. The bag is marked and sent to the

laboratory the same day. The sample is examined for Salmonella according to Nordic Committee on Food Analysis.

Breeding flocks: Production period

See "Breeding flocks: Day-old chicks"

Meat production flocks: Before slaughter at farm

See "Breeding flocks: Day-old chicks"

Meat production flocks: At slaughter (flock based approach)

see "Salmonella in broiler meat and products thereof"

Case definition

Breeding flocks: Day-old chicks

If salmonella is isolated from an individual animal, the whole flock is considered salmonella infected. In poultry, the flock is the epidemiological unit.

Breeding flocks: Rearing period

See "Breeding flocks: Day-old chicks"

Breeding flocks: Production period

See "Breeding flocks: Day-old chicks"

Meat production flocks: Day-old chicks

See "Breeding flocks: Day-old chicks"

Meat production flocks: Rearing period

See "Breeding flocks: Day-old chicks"

Meat production flocks: Before slaughter at farm

See "Breeding flocks: Day-old chicks"

Meat production flocks: At slaughter (flock based approach)

A positive neck skin sample at slaughter results in restriction on the holding of origin and additional official sampling at the holding. If the official samples are positive the farm is considered infected

Diagnostic/ analytical methods used

Breeding flocks: Day-old chicks

Bacteriological method: NMKL No 71:1999

Breeding flocks: Rearing period

Bacteriological method: NMKL No 71:1999

Breeding flocks: Production period

Bacteriological method: NMKL No 71:1999

Meat production flocks: Day-old chicks

Bacteriological method: NMKL No 71:1999

Meat production flocks: Rearing period

Bacteriological method: NMKL No 71:1999

Meat production flocks: Before slaughter at farm

Bacteriological method: NMKL No 71:1999

Meat production flocks: At slaughter (flock based approach)

Bacteriological method: NMKL No 71:1999

Vaccination policy

Breeding flocks

Vaccination is prohibited

Meat production flocks

See "Breeding flocks"

Other preventive measures than vaccination in place

Breeding flocks

High bio-security rules at the same level as for other breeding stocks. These flocks are raised indoors.

Meat production flocks

Controlled feed, salmonella free ducklings.

Control program/ mechanisms

The control program/ strategies in place

Breeding flocks

Strict hygiene rules are enforced on breeding stock which is kept indoors with the same preventive measures implemented as for other breeding poultry. The rules are in line with what is required within the Prophylactic volontary salmonella control programme even though duck farms are not accepted within the programme. It includes: a)Rules

for feed production and transport, b) hygienic rules to protect the birds from salmonella infection from the surroundings, c) salmonella free newly hatched
ducklings are delivered from the hatcheries, d) precaution to stop spread of salmonella from an infected flock, and e) all- in - all out principle in all houses. At some of the breeding duck farms no preventive measures are implemented.

Meat production flocks

These are raised out-doors. Following rules may be applied at some holdings: a)Rules for feed production and transport, b) salmonella free newly hatched ducklings from the hatcheries, c)precaution to stop spread of salmonella from an infected flock

Measures in case of the positive findings or single cases

Restrictions, culling of infected animals, destruction, cleaning and disinfection and finally environmental negative samples before restrictions are lifted.

Notification system in place

All findings of salmonella is compulsory notifiable. The obligation to notify all salmonella findings has been in force since 1961.

Results of the investigation

S. paratyphi Java was isolated from one meat production flock. S. Typhimurium was isolated from 2 holdings; one open farm and one small private farm.

National evaluation of the recent situation, the trends and sources of infection

Since 1996, the situation has remained stable with none to a few infected flocks per year.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Swedish produced red and white meat are virtually free from salmonella, the risk of contracting salmonella from food products of domestic animal origin is very small.

F. Salmonella spp. in pigs

Monitoring system

Sampling strategy

Breeding herds

Sampling strategies are described in the Swedish Salmonella control programme (95/ 50/ EC). The programmes are supervised by the SJV and the SLV. All sampling according to the salmonella programme is performed or supervised by the competent authority, that is official veterinarians. They are responsible for the sampling in the herds, cuttingplants and in the slaughter houses.
Within the programme, lymph nodes and carcass swabs are systematically collected

from fattening and adult pigs at slaughter to ensure that the samples are representative of the population of slaughtered pigs at each slaughterhouse. Sampling of lymph nodes in the programme is described here, whereas sampling of carcass swabs and at cutting plants are described under "Salmonella spp. in pig meat and products thereof".
CONTROL PROGRAMME
Sampling of lymph nodes at slaughter houses:
Slaughter houses have been divided into two categories: Category A slaughtering 90% of all pigs and Category B slaughtering 10% of all pigs.
Category A: At each slaughterhouse a sufficient number of samples is collected to detect at least 5% salmonella infected/ contaminated carcasses with 95% confidence interval (CI) in the annual slaughter. Sampling is performed daily in Category A and samples consist of lymph nodes from the ileo-caecal region.
Samples are collected evenly distributed over the day and if slaughter is performed on separate lines, each will be sampled separately.
Category B: These slaughterhouses are controlled as one unit. Enough samples to detect a prevalence of 1% salmonella infected carcases with 90% CI will be taken. These samples consist of lymph nodes from the ileo-caecal region. Sampling wil be spread out over the slaughter days to avoid periodical sampling.
VOLUNTARY PROGRAMME
There is a voluntary additional sampling of faecal materials at herd level in a quality programme called BIS (Best In Sweden) run by the industry (Swedish meats). In this programme, integrated- , fattening-, piglet producing-, and satellite herds are includuded. Sampling is performed by the veterinarian.
OTHER SAMPLING
Sampling at farms and abattoirs is performed whenever there is a clinical suspicion. There is also mandatory sampling at import of animals.

Multiplying herds

see "breeding herds"

Fattening herds

see "breeding herds"

Frequency of the sampling

Breeding herds

Other: 1) lymph nodes at Category A: daily, Catergory B: spread out evenly over the year , 2) sampling at suspicion/ outbreak, 3) faecal samples once a year

Multiplying herds

Other: 1) lymph nodes at Category A: daily, Catergory B: spread out evenly over the year , 2) sampling at suspicion/ outbreak, 3) faecal samples once a year

Fattening herds at farm

Other: 1) lymph nodes at Category A: daily, Catergory B: spread out evenly over the

year , 2) sampling at suspicion/ outbreak, 3) faecal samples once a year

Fattening herds at slaughterhouse (herd based approach)

Other: see "fattening herds at farm"

Type of specimen taken

Breeding herds

Other: feaces and lymph nodes

Multiplying herds

Other: feaces and lymph nodes

Fattening herds at farm

Other: feaces and lymph nodes

Fattening herds at slaughterhouse (herd based approach)

Other: see "fattening herds at farm"

Methods of sampling (description of sampling techniques)

Breeding herds

CONTROL PROGRAMME
1)Faecal sampling
Sampling procedure:
For individual sampling, at least 10 g faeces from each animal is collected. From pens with growers/ finisher pigs pooled faecal samples of at least 50g (10g from each of at least 5 animals/ pen) is collected. All samples should be analysed within 24-48 h after collection.
Bacteriological examination:
From individual samples, 5 g faeces is examined while the remaining part is stored at +4C until examination is completed. Material from at most 15 animals are pooled. If salmonella is isolated from a pooled sample, each of the individually stored samples can be examined for salmonella separately.
For sampling at suspicion or in outbreak investigations feacal samples are only pooled for fattening pigs and not for adult pigs.
2)Lymph nodes at slaughter:
At least 5 lymph nodes from the ileo-caecal region are aseptically removed and put in a plastic bag. The samples are kept refrigerated until sent to the laboratory. At the laboratory all lymph nodes from one sample are divided into two equal parts. One half is placed in a mortar and the other part is kept at +4 C. In the mortar, lymph nodes from 15 animals are pooled and homogenised. If salmonella is isolated from a pooled sample of lymph nodes each of the individually stored samples will be analysed separately.

Multiplying herds

See "breeding herds"

Fattening herds at farm

1) For sampling of lymph nodes and feacal sampling at suspicion or at outbreak investigation, see "Breeding herds".
2) Faecal sampling in the voluntary programme (BIS).
Samples are taken every second year in all farms affiliated to the programme, including integrated-, fattening-, piglet producing- and satellite herds. Two pooled faecal samples from 5 pens, respectively, are collected.

Fattening herds at slaughterhouse (herd based approach)

For sampling of lymph nodes, see "breeding herds".

Case definition

Breeding herds

If salmonella is isolated from a pig, then the whole herd is considered infected with salmonella. The herd is the epidemiological unit.

Multiplying herds

see under "breeding herd"

Fattening herds at farm

see under "breeding herd"

Fattening herds at slaughterhouse (herd based approach)

see under "breeding herd"

Diagnostic/ analytical methods used

Breeding herds

Bacteriological method: NMKL No 71:1999

Multiplying herds

Bacteriological method: NMKL No 71:1999

Fattening herds at farm

Bacteriological method: NMKL No 71:1999

Fattening herds at slaughterhouse (herd based approach)

Other:

Vaccination policy

Breeding herds

Vaccination is not allowed in Sweden.

Multiplying herds

see under "breeding herd"

Fattening herds

see under "breeding herd"

Other preventive measures than vaccination in place

Breeding herds

In pigs and other food-producing animals salmonella control in feed- and feed production (HACCP based approach) is integrated with the control programme to ensure that feed to food producing animals virtually is free from Salmonella.
Apart from this, there is also a voluntary hygiene programme in herds since 2002 run by the industry and supervised by the SJV. In this programme, certain rules of hygiene and standardised preventive measures have to be implemented. Affiliation to the the voluntary control programme implies a higher level of economic compensation in case salmonella infection.
There is also voluntary additional sampling in a health programme called BIS (Best In Sweden or Baest i Sverige) run by the industry (Swedish meats).

Multiplying herds

see "breeding herds"

Fattening herds

see "breeding herds"

Control program/ mechanisms

The control program/ strategies in place

Breeding herds

The control programme is outlined in the Swedish Salmonella control programme, approved by the EU in 1995 (95/ 50/ EC). The programme is nation-wide, thus it covers all herds in Sweden, also those that may deliver their animals abroad.
The salmonella control programme is officially supervised and includes: a) Compulsory notification of all findings of salmonella, as well as suspicion of Salmonella, regardless of serotype, b) Compulsory action if Salmonella is isolated, including prohibition on placing animals on the market, c) Examination for Salmonella in animals slaughtered under special conditions (e.g diseased animals or when salmonella is suspected), and d) Control programme at slaughter houses and in herds,

and clinical surveillance in herds.
As breeding herds and multiplying herds constitute the top of the breeding pyramide, a complementary monitoring is performed in these herds at farm level.

Multiplying herds

see "breeding herds"

Fattening herds

see "breeding herds"

Measures in case of the positive findings or single cases

1)If Salmonella is isolated from pigs and other food-producing animals, indicating a herd infection, restrictions are put on the farm/ herd. Such restrictions may include a ban of transport (unless transport to sanitary slaughter), collection of bacteriological samples of the whole herd, and institution of a sanitation plan, i.e. involving elimination of chronically infected animals, cleaning and disinfection, treatment of manure and sludge, and destruction of feeding stuffs. Trace-back and trace-forward investigations are also performed. Also, the feed supplier is investigated. Restrictions are lifted when faecal samples from all animals in the epidemiological unit (usually the herd) taken at two consecutive samplings one month apart are negative.
Isolated salmonella strains have to be sent in to the SVA for typing and testing of antimicrobial resistance.
2)If salmonella is found from any lymph node collected in the control programme (including animals from breeding, multiplying and fattening herds) trace back of the infection to the farm of origin is always performed.
3) If salmonella is isolated from other animals, humans or feed and connections can be made to pigs, investigation is always performed.
4)Every carcass that is contaminated by Salmonella is deemed unfit for human consumption.

Notification system in place

All findings of salmonella, irrespective of serotype, are compulsory notifiable. The obligation to notify all salmonella findings has been in force since 1961. Suspicions of salmonella are also notifiable.

Results of the investigation

1)In 2006, there was an outbreak related to imported feed. Salmonella was detected in the feeding system of 25 farms and in the animals of 3 farms. S. Livingstone, S. Infantis, S. Agona and S. Typhimurium were isolated from animals. Two serotypes were detected at 3 farms (S. Livingstone & S. Agona, S. Livingstone & S. Schwarzgrund, S. Livingstone & S. Infantis). See 'Salmonella in feed' for serotypes isolated only in the feed.
2) S. Typhimurium DT 104 was detected at one farm with slaughter pigs. The same serotype was detected at a neighbouring cattle farm.
3) In the control programme, 5950 lymph nodes were analysed (2794 adult swine, 3153 fattening pigs). Of these, 10 were positive. Salmonella was isolated from 7 samples taken from adult swine: S. Typhimurium DT 40 (3 samples), S. Typhimurium DT 120, S. Agona, S. Braenderup and S. Oranienburg.

Salmonella was isolated from three samples from fattening pigs: S. Typhimurium DT 41, S. Typhimurium NT and S. Agona. At two occasions Salmonella was re-isolated at the farm of origin (S. Typhimurium DT 40 and DT 120). The same serotypes have been isolated from the two farms earlier. S. Typhimurium DT 120 was isolated from the farm during the feed outbreak in 2006 and S. Typhimurium DT 40 from the other farm in 2004.
4)In the voluntary control run by the industry (Swedish Meats) 550 pooled faecal samples from 976 herds were analysed. All were negative.

National evaluation of the recent situation, the trends and sources of infection

The situation in Sweden remains favourable. From the beginning of the 80's there has, in general, been less than 5 infected herds per year. There have been even less infected farms since 2000, with the exception of outbreaks caused by contaminated feed in 2003 (S. Cubana at 30 herds) and in 2006. Control of feed is extremely important in order to prevent Salmonella infections in swine.
See also "Salmonella spp. in pig meat and products".

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As <0.1% of Swedish pigs are infected with salmonella, the risk of contracting salmonella from Swedish food produced from pigs is small.

Additional information

Apart from sampling of animals in the voluntary and mandatory salmonella programmes at herd- and slaughter level, there is extensive sampling at feed mills at critical control points to ensure production of feed virtually free from salmonella contamination.

G. Salmonella spp. in bovine animals

Monitoring system

Sampling strategy

Sampling strategies are described in the Swedish Salmonella control programme (95/ 50/ EC). The programmes are supervised by the SJV and the SLV. All sampling according to the salmonella programme is supervised by the competent authority, that is official veterinarians. They are responsible for the sampling in the herds, cuttingplants and in the slaughter houses.
Within the programme, lymph nodes and carcass swabs are systematically collected from cattle at slaughter to ensure that the samples are representative of the population of slaughtered cattle at each slaughterhouse. Sampling of lymph nodes in the programme is described here, wheras sampling of carcass swabs and at cutting plants are described under " Salmonella spp. in bovine meat and products thereof".
CONTROL PROGRAMME
Cat.A: At each slaughterhouse a sufficient number of samples is collected to detect at least 5% salmonella infected/ contaminated carcasses with 95% Confidence Interval (CI) in the annual slaughter. Sampling is performed daily in Cat.A. and samples consist of lymph nodes from the ileo-caecal region. At these abattoirs samples are collected evenly distributed over the day and if slaughter is performed on separate lines, each will be sampled separately.

Cat.B: These slaughterhouses are controlled as one unit. Enough samples to detect a prevalence of 1% salmonella infected carcasses with 90% CI will be taken. These samples consist of lymph nodes from the ileo-caecal region. Sampling is spread out over the slaughter days to avoid periodical sampling.
OTHER SAMPLING
Sampling at farms is performed whenever there is a clinical suspicion. Animals that are bought to a farm under certain defined criteria are also sampled.

Frequency of the sampling

Animals at farm

Other: 1) lymph nodes at Category A: daily, category B: spread out evenly over the year, 2) sampling at suspicion / outbreak/ sanitary slaughter

Animals at slaughter (herd based approach)

Other: see lymph nodes at "Animals at farms"

Type of specimen taken

Animals at farm

Other: faeces and lymph nodes

Animals at slaughter (herd based approach)

Other: see Animals at farms

Methods of sampling (description of sampling techniques)

Animals at farm

FAECAL SAMPLING:
Sampling procedure:
For individual sampling, at least 10 g faeces from each animal is collected. From pens with calves/ young stock pooled faecal samples of at least 50g (10g from each of at least 5 animals/ pen) is collected. All samples should be analysed within 24-48 h after collection.
Bacteriological examination:
From individual samples, 5 g faeces is examined while the remaining part is stored at +4C until examination is completed. Material from at most 15 animals are pooled. If salmonella is isolated from a pooled sample, each of the individually stored samples can be examined for salmonella separately.
LYMPH NODES AT SLAUGHTER:
The lymph nodes are aseptically removed and put in a plastic bag. The samples are kept refrigerated until sent to the laboratory. At the laboratory all lymph nodes from one sample is divided into two equal parts. One half is placed in a mortar and the other part is kept at 4o C. In the mortar lymph nodes from 15 animals are pooled and homogenised. If salmonella is isolated from a pooled sample of lymph nodes each of the individually stored samples will be analysed separately.

Animals at slaughter (herd based approach)

For information about lymph nodes, see "Animals at farm". For information about carcass swabs and cutting plants, see "Salmonella spp. in bovine meat and products thereof".

Case definition

Animals at farm

If salmonella is isolated from a cattle, then the whole herd is considered infected with salmonella. The herd is the epidemiological unit.

Animals at slaughter (herd based approach)

see "Animals at farm"

Diagnostic/ analytical methods used

Animals at farm

Other: NMKL 71:1999 or a modified ISO 1992. For analyses of faecal samples from cattle cystein and selenite broth is sometimes used.

Animals at slaughter (herd based approach)

Other: see Salmonella spp. in bovine meat and products thereof or Animals at farm

Vaccination policy

Vaccination is not allowed.

Other preventive measures than vaccination in place

In food-producing animals salmonella control in feed and in feed production (HACCP based approach)is integrated in the salmonella control.
Apart from this, there is also a voluntary hygiene programme since 2002 run by the industry and supervised by the SJV. In this programme, certain rules of hygiene and standardised preventive measures have to be implemented. Affiliation to the the voluntary control programme imply a higher level of economic compensation in case salmonella infection.

Control program/ mechanisms

The control program/ strategies in place

Control strategies follow the Swedish Salmonella control programme, approved by the EU in 1995 (95/ 50/ EC).
The control programme is nation-wide, thus it covers all herds in Sweden, also those that may deliver their animals abroad. The salmonella control programme is officially supervised and includes: a) Compulsory notification of all findings of salmonella and suspicions of salmonella, regardless of serotype, b) Compulsory action if salmonella is isolated, including prohibition on placing animals on the market, c) Examination for salmonella in animals slaughtered under special conditions (e.g diseased animals or when salmonella is suspected), and d) Control

programme at slaughter houses and in herds, and clinical surveillance in herds.

Measures in case of the positive findings or single cases

1)If Salmonella is isolated from cattle and other food-producing animals, indicating a herd infection, restrictions are put on the farm/ herd. Such restrictions may include a ban of transport (unless transport to sanitary slaughter), collection of bacteriological samples of the whole herd, and institution of a sanitation plan, i.e. involving elimination of chronically infected animals, cleaning and disinfection, treatment of manure and sludge, and destruction of feeding stuffs. Trace-back and trace-forward investigations are also performed. Also, the feed supplier is investigated. Restrictions are lifted when faecal samples from all animals in the epidemiological unit (usually the herd) taken at two consecutive samplings one month apart are negative.
Isolated salmonella strains have to be sent in to the SVA for typing and testing of antimicrobial resistance.
2)If salmonella is found from any lymph node collected in the control programme trace back of the infection to the farm of origin is always performed.
3) If salmonella is isolated from other animals, humans or feed and connections can be made to cattle, investigation is always performed.
Contaminated carcasses are deemed unfit for human consumption.

Notification system in place

All findings of salmonella are compulsory notifiable. The obligation to notify all salmonella findings has been in force since 1961. Suspicion of salmonella infection is also notifiable.

Results of the investigation

In 2006, Salmonella was isolated from 9 farms. The following serotypes were isolated:
1) 5 S. Dublin.
2) 2 S. Typhimurium. S. Typhimurium NT and susceptible S. Typhimurium DT 104. DT 104 was also isolated at the neighbouring farm with slaughter pigs.
3) 1 S. Dusseldorf.
4) 1 S. Agona.
In 2006 in the surveillance in the control programme, 3518 lymph nodes were analysed. Of those, 2 were positive for S. Typhimurium NT. Salmonella could not be isolated at the farms of origin. One carcass swab sample was positive for multi-resistant S. Typhimurium DT 104.
In addition, Salmonella was isolated from 5 individual animals but the bacterium was not detected at farm. The five cases were:
2 S. Duesseldorf (necropsy and meat inspection), 1 S. Dublin (necropsy), S. Typhimurium DT 10 (cattle sale), S. Typhimurium NT (necropsy).
For results from sampling at cutting plants in the salmonella control programme, see "Salmonella spp. in bovine meat and products thereof".

National evaluation of the recent situation, the trends and sources of infection

The situation remains very favourable with few infected farms each year. During the 1980s' the number of salmonella infected cattle farms declined rapidly. Since the end of the 1990's the number of farms infected varied from 4 to 13 per year.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a

source of infection)

The risk of contracting salmonella from Swedish produced food of cattle origin is negligble as <0.1% of Swedish cattle is infected with salmonella.

Additional information

In 2006, one cattle farm was infected with a susceptible S. Typhimurium DT 104.

H. Salmonella spp. in animal

Monitoring system

Sampling strategy

Described here is salmonella in other animal species (such as horses, pets and wild life) than the ones covered in the salmonella control programme.
Sampling at farms/ holdings or of individual animals is performed whenever there is a clinical suspicion. Sampling may also be performed at autopsy. Wild life sent to the SVA for autopsy may be tested for salmonella.

Case definition

Animals at farm

If salmonella is isolated from an individual dog, horse or cat, the whole kennel/ holding/ stable etc. is considered positive. However, if salmonella is isolated from other animal species, each animal is regarded positive.

Vaccination policy

Vaccination is not used in Sweden.

Measures in case of the positive findings or single cases

If Salmonella is isolated from food-producing animals (including horses), indicating a herd infection, restrictions are put on the farm/ herd according to Swedish legislation. For other domestic animal species, proper actions are taken in order to eliminate the infection and prevent spread of salmonella.

Notification system in place

All findings of salmonella are compulsory notifiable. The obligation to notify all salmonella findings has been in force since 1961.

Results of the investigation

Early in 2006, there was an outbreak of S. Typhimurium in cats and 77 cases were reported. In addition, S. Enteritidis was isolated from 2 cats. It is suspected that the cats acquire the infection by wild birds.
Furthermore, Salmonella was isolated from 6 dogs, 1 horse, 6 reptile pets, 14 wild birds and 4 wild mammals. The various serotypes are shown in the table "Salmonella in other animals".

National evaluation of the recent situation, the trends and sources of infection

The situation remains stable.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

It has been reported that findings of salmonella in reptiles kept as pets pose a risk for transmission of salmonella to humans. For other animal species, transmission to humans is regarded to be very limited.

Additional information

Since 2003, there have been yearly outbreaks of Salmonella Typhimurium in cats during late winter/ early spring. In 2003, 114 cats were reported, followed by 31 in 2004. Phage type 40 has been the dominating type among the samples that were phagetyped. In 2005, 138 cats with S. typhimurium were reported. In 2006, 77 cats with S. Typhimurium were reported.

Table Salmonella in breeding flocks of Gallus gallus

	Source of information	Sampling unit	Units tested	Total units positive for Salmonella spp.	S. Enteritidis	S. Typhimurium	Salmonella spp., unspecified	S. Senftenberg
Gallus gallus (fowl)								
parent breeding flocks for egg production line (1)	SJV							
day-old chicks	SJV	flock	37	0				
during rearing period	SJV	flock	16	0				
during production period	SJV	flock	21	0				
grandparent breeding flocks for meat production line	SJV	flock	15	2		1		1
parent breeding flocks for meat production line (2)	SJV							
day-old chicks	SJV	flock	127	0				
during rearing period	SJV	flock	64	4		4		
during production period	SJV	flock	63	0				

(1) : Total number of flocks is 37. None tested positive.
(2) : Total number of flocks is 127. Four flocks were positive for Salmonella.

Table Salmonella in other poultry

	Source of information	Sampling unit	Units tested	Total units positive for Salmonella spp.	S. Paratyphi B var. Java	S. Enteritidis	S. Typhimurium	Salmonella spp., unspecified	S. Worthington	S. Paratyphi
Gallus gallus (fowl)										
laying hens										
during rearing period	SJV	flock	243	0						
during production period	SJV	flock	670	1			1			
broilers										
during rearing period	SJV	flock	2351	5			5			
Ducks	SJV	flock	20	2			2			
meat production flocks (1)		flock	20	1	1				1	
Geese										
meat production flocks		flock	12	0						
Turkeys										
breeding flocks	SJV	flock	12	0						
meat production flocks	SJV	flock	140	0						

(1) : S. Paratyphi Java and S. Worthington were isolated from the duck flock.

Footnote

S. Paratyphi Java and S. Worthington were isolated from geese belonging to the same flock.

Table Salmonella in other birds

	Source of information	Sampling unit	Units tested	Total units positive for Salmonella spp.	S. Enteritidis	S. Typhimurium	Salmonella spp., unspecified
Birds							
wild		animal	20	13		13	

Footnote

Units tested is only known for analyses performed at SVA.

Table Salmonella in other animals

	Source of information	Sampling unit	Units tested	Total units positive for Salmonella spp.	S. Enteritidis	S. Typhimurium	Salmonella spp., unspecified	S. Florida	S. Agona	S. Oranienburg	S. Bredeney	S. Liverpool	S. Livingstone	S. Derby	S. Dublin	S. Duesseldorf	S. Braenderup	S. Infantis
Cattle (bovine animals)	SIV	herd	17	9		2			1						5	1		
adult cattle over 2 years - at slaughterhouse - animal sample - lymph nodes - Control or eradication programmes - national programmes (no Community co-financing) - official sampling - objective sampling (2)	SLV	animal	3518	2		2												
- at slaughterhouse - animal sample - carcass swabs - Control or eradication programmes - national programmes (no Community co-financing) - official sampling - objective sampling (3)	SLV	animal	3510	1		1												
Pigs (1)	SIV	herd	10	5		2			2				2					1

breeding animals																	
- at slaughterhouse - animal sample - lymph nodes - Control or eradication programmes - national programmes (no Community co-financing) - official sampling - objective sampling (4)	SLV	animal	2794	7	4				1	1						1	
- at slaughterhouse - animal sample - carcass swabs - Control or eradication programmes - national programmes (no Community co-financing) - official sampling - objective sampling (5)	SLV	animal	2767	0													
fattening pigs																	
- at slaughterhouse - animal sample - lymph nodes - Control or eradication programmes - national programmes (no Community co-financing) - official sampling - objective sampling (6)	SLV	animal	3153	3	2				1								
- at slaughterhouse - animal sample - carcass swabs - Control or eradication programmes - national programmes (no Community co-financing) - official sampling - objective sampling (7)	SLV	animal	3151	0													
mixed herds																	

raised under controlled housing conditions in integrated production system																		
- at farm - animal sample - faeces - Monitoring - sampling by industry (8)	Swedish Meats	herd	976	0														
Solipeds, domestic	SVA	animal	127	3		3												
Dogs	SVA	animal	133	7		2			2		1	1		1				
Cats	SVA	animal	128	79	2	77												
Reptiles																		
pet animals	SVA	animal	17	6		1	4	1										

(1) : Two serotypes were detected at two farms: S. Agona & S. Livingstone in one and S. Infantis & S. Livingstone in the other.
(2) : 3313 lymph nodes from major abattoirs and 205 from minor. Salmonella was not re-isolated in the herd of origin.
(3) : 3301 carcass swabs from major abattoirs and 209 from minor.
(4) : 2766 samples from major abattoirs, 28 from minor. Salmonella was re-isolated at two farms.
(5) : 2739 swabs from major abattoirs, 28 from minor.
(6) : 2913 lymph nodes from major abattoirs, 240 from minor. Salmonella was not re-isolated at the farm of origin.
(7) : 2911 swabs from major abattoirs, 240 from minor.
(8) : 550 pooled faecal samples from 976 herds in the voluntary programme BIS run by the industry.

Footnote

The figures of solipeds, dogs, cats and reptiles tested covers only analyses performed at SVA.

2.1.5. Salmonella in feedingstuffs

A. Salmonella spp. in feed

History of the disease and/ or infection in the country

(Note from the editors: Parts of the text below does not fit the premade text form, therefore text has been entered under "History of the disease...", "National evaluation..." and "Additional information". We include this text as Salmonella control in feed is integrated in the Swedish Salmonella control programme.
Current situation:
All sampling follow the legislation on feeding stuffs and animal by-products and is supervised by the SJV. In addition to the compulsory testing, a large number of voluntary samples are taken. All Salmonella findings are sent to the SVA for confirmation and serotyping.
Analytical method used:
The bacteriological method used is NMKL method No 71 (5th ed., 1999). Serotyping is performed by slide agglutination. Certain serotypes are subtyped by molecular methods. The compulsory samples taken at the feed mills are analysed at the SVA. Also, samples taken by official feed inspectors and "hygiene groups", consisting of the county veterinarian and an official feed inspector, are analysed at the SVA. Other samples may be analysed at other accredited laboratories. Most analysing laboratories are accredited according to EN/ 150/ 17025.

National evaluation of the recent situation, the trends and sources of infection

Sampling at feed mills:
At the feed mills, samples are taken mainly according to Hazard Analysis Critical Control Point (HACCP) principles, both on the premises and along the production line. The HACCP system was initiated in 1991 and has proven to be effective for detecting and preventing Salmonella in feeding stuffs. Feed mills that produce feeding stuffs for poultry are obliged to take a minimum of five samples per week from specified critical control points. Feed mills that produce feeding stuffs for ruminants, pigs or horses, are obliged to take two samples a week. The producer often takes additional voluntary samples. Official feed inspectors sample at specified points at the feed mills, one to five times a year, depending on production volume. Also, a so-called hygiene group makes yearly inspections at feed mills that produce more than 1000 tons of feeding stuffs annually. Feed mills that produce less are visited less frequently. At these inspections, samples are taken at critical points - especially in connection with coolers, aspirators and elevators.
Sampling of feed materials:
Feed materials are classified according to the Salmonella risk they may present: feed materials of animal origin (S1), high risk feed materials of vegetable origin (S2, e.g. soy bean meal and some products deriving from rape seed), and low risk feed materials of vegetable origin (S3, e.g. rice). Production of these classified feed materials has to follow a hygiene programme, containing routines for Salmonella sampling, should be approved by the SJV.
All consignments of feed materials classified as S1, S2 and S3 that is traded into Sweden have to be sampled, either in Sweden or in the country of origin. If the consignment was sampled outside Sweden, it must be proved that the required samples have been taken.
Feed material of animal origin has to be sampled according to regulation (EC) No 1774/ 2002. If the production is continuous, the number of samples to be taken is decided by the SJV. In addition to this, many voluntary samples are collected.

Sampling of compound feeding stuffs traded into Sweden:
All compound feeding stuffs (S1, S2 or S3) traded into Sweden and produced for ruminants, pigs or poultry, are tested for Salmonella following the same principles as feed raw materials.
Processing plants for animal by-products and feed material of animal origin: Feed materials of animal origin are sampled in accordance with the EU legislation. Many voluntary samples are also taken.
Pet food: Every company producing pet food is regularly inspected and the feed is sampled for Salmonella once a year by an official feed inspector. In addition to this, voluntary samples are taken. Every consignment of dog chews from a third country is sampled at the border inspection, even though it must be accompanied by a certificate showing that the pet food has been tested negative for Salmonella in compliance with the EU legislation. Dog chews that are found positive for Salmonella are rejected. Pet food produced by animal by-products have to be sampled for Salmonella according to regulation (EC) No 1774/ 2002.
Measures in case of positive findings: No feed materials containing, or suspected of containing, Salmonella may be used in the production of feeding stuffs. Positive Salmonella findings always give rise to further testing and decontamination.

Additional information

Heat treatment: All compound feeding stuffs for poultry have to be heat treated to >75°C. In practice, a great amount of feeding stuffs for ruminants and pigs are also heat treated. Non heat-treated feed grains for sale, aimed for poultry on farm, have to originate from a storage plant that has been approved by the SJV. All storage facilities must fulfil certain requirements regarding sampling.
RESULTS FROM 2006 In the tables, the compulsory samples, the sample staken in the official control and the voluntary samples that have been reported to the SJV are presented. There is no obligation to report negative results from voluntary samples.
FEED MILLS AND COMPUND FEEDING STUFFS In the HACCP control of feed mills, 8679 samples were reported and of those 40 were positive. The positive samples belonged to 13 serotypes (Table Salmonella in compound feeding stuffs). The most commonly isolated serotypes (each n=9) were S. Mbandaka, S. Senftenberg and S. Typhimurium.
FEED MATERIAL OF VEGETABLE ORIGIN In total, 3936 samples from derived material of soybean, maize, palm kernel and rape seed were analysed. Of those, 65 were positive. No sample from maize derive was positive. The most common serotype was S. Agona (n=6). Furthermore, 891 environmental samples from domestic rape seed processing plants were analysed. Of those, 18 were positive and all were of the serotype Mbandaka. (Table Salmonella in other feed materials)
PROCESSING PLANTS FOR ANIMAL BYPRODUCTS AND FEED MATERIALS OF ANIMAL ORIGIN Out of 2813 samples from feed materials of land animal origin, 12 were positive. (Table Salmonella in feed material of animal origin). One out of 272 samples from fish meal was positive.
SALMONELLA OUTBREAK IN FEED, 2006
In 2006, there was an outbreak related to imported feed. Salmonella was detected in the feeding system of 25 pig farms and in the animals in 3 pig farms farms. Seven different serotypes were detected: S. Livingstone (12 farms), S. Infantis (8 farms), S. Agona (8 farms), S. Lexingstone (1 farm), S. Ohio (1 farm), S. Schwarzgrund (1 farm) and S. Typhimurium DT 120 (1 farm). S. Livingstone, S. Infantis, S. Agona and S. Typhimurium were isolated from animals. Two serotypes were detected at 3 pig farms (S. Livingstone & S. Agona, S. Livingstone & S. Schwarzgrund, S. Livingstone & S. Infantis).

Table Salmonella in feed material of animal origin

	Source of information	Sampling unit	Sample weight	Units tested	Total units positive for Salmonella spp.	S. Enteritidis	S. Typhimurium	Salmonella spp., unspecified	S. Senftenberg	S. Oranienburg	S. Bredeney	S. Agona	S. Mbandaka	S. Montevideo
Feed material of land animal origin														
meat and bone meal	SJV	batch		72	0									
bone meal	SJV	single		839	12				3		3	3	2	1
greaves	SJV	single		1074	0									
poultry offal meal	SJV	batch		752	0									
egg powder	SJV	single		76	0									
Feed material of marine animal origin														
fish meal	SJV	batch		272	1					1				

Footnote

Compulsory (national or EU requirements) and voluntary sampling. Negative voluntary sampling is not included in the table as number of samples are unknown, thus, samples are collected from materials not included in the table. Sample weight is unknown and may vary between samples.

Table Salmonella in other feed matter (Part A)

	Source of information	Sampling unit	Sample weight	Units tested	Total units positive for Salmonella spp.	S. Typhimurium	S. Enteritidis	Salmonella spp., unspecified	S. Livingstone	S. Agona	S. Yoruba	Other serotypes	S. Tennessee	S. Mbandaka	S. Infantis	S. Minnesota	S. Adelaide	S. Senftenberg	S. Cubana	S. Meleagridis
Feed material of cereal grain origin																				
maize derived	SJV	batch		184	0															
Feed material of oil seed or fruit origin																				
rape seed derived (1)	SJV	batch		1128	11					4		6			1					
- at feed mill - environmental sample (3)	SJV	single		891	23									17				5	1	
- at feed mill - domestic production	SJV	single		1620	18									18						
palm kernel derived	SJV	batch		276	8			6		1		1								
soya (bean) derived (2)	SJV	batch		728	28			5	2	1	2	3	1	2		1	1	4	3	1

(1) : imported
(2) : S. Subspecies I n=1 included in S. other serotypes
(3) : samples from domestic rape seed processing plant

Footnote

Compulsory (national or EU requirements) and voluntary sampling. Negative voluntary sampling from the final product is not included in the table as number of samples are unknown, thus, samples are collected from materials not included in the table. Sample weight is unknown and may vary between materials.

Table Salmonella in other feed matter (Part B)

	S. Muenster	S. Gabon
Feed material of cereal grain origin		
maize		
derived		
Feed material of oil seed or fruit origin		
rape seed derived (1)		
- at feed mill - environmental sample (3)		
- at feed mill - domestic production		
palm kernel derived		
soya (bean) derived (2)	1	1

(1) : imported
(2) : S. Subspecies I n=1 included in S. other serotypes
(3) : samples from domestic rape seed processing plant

Footnote

Compulsory (national or EU requirements) and voluntary sampling. Negative voluntary sampling from the final product is not included in the table as number of samples are unknown, thus, samples are collected from materials not included in the table. Sample weight is unknown and may vary between materials.

Table Salmonella in compound feedingstuffs

	Source of information	Sampling unit	Sample weight	Units tested	Total units positive for Salmonella spp.	S. Typhimurium	S. Enteritidis	Salmonella spp., unspecified	S. Cubana	S. Emek	S. Agona	S. Panama	S. Livingstone	S. Meleagridis	S. Cerro	S. IIIa	S. Paratyphi B var. Java	S. Mbandaka	S. Senftenberg
Compound feedingstuffs, not specified																			
process control																			
- at feed mill - environmental sample - Surveillance - HACCP or own checks by industry - sampling by industry (1)	SJV	single		8679	40	9		2	1	1	2	1	2	1	1	1	1	9	9

(1) : Mandatory weekly sampling

Footnote

Compulsory (national or EU requirements) and voluntary sampling. Sampling in the process is performed using the HACCP principles.
Negative voluntary sampling from the final product is not included in the table as number of samples are unknown, thus, samples are collected from materials not included in the table.
Sample weight is unknow and may vary between materials.

2.1.6. Salmonella serovars and phagetype distribution

The methods of collecting, isolating and testing of the Salmonella isolates are described in the chapters above respectively for each animal species, foodstuffs and humans. The serotype and phagetype distributions can be used to investigate the sources of the Salmonella infections in humans. Findings of same serovars and phagetypes in human cases and in foodstuffs or animals may indicate that the food category or animal species in question serves as a source of human infections. However as information is not available from all potential sources of infections, conclusions have to be drawn with caution.

Table Salmonella serovars in animals

Serovars		Cattle (bovine animals)		Pigs		Gallus gallus (fowl)		Other poultry	
Sources of isolates (*)		M	C	M	C	M	C	M	C
Number of isolates in the laboratory	N=	3	14	10	6				
Number of isolates serotyped	N=	3	14	10	6	4	11	4	0
Number of isolates per type									
S. Agona			1	2	1	3			
S. Braenderup				1					
S. Dublin			6						
S. Duesseldorf			3						
S. Infantis					1				
S. Livingstone					2				
S. Oranienburg				1					
S. Rubislaw						1			
S. Senftenberg							1		
S. Typhimurium		3	4	6	2		10	2	
S. Worthington								1	
S. Paratyphi B var. Java								1	
Salmonella spp., unspecified									

Footnote

(*) M : Monitoring, C : Clinical
Isolates classified as Monitoring have been detected in the national control program. All primary isolates are listed in this table. Therefore the number of isolates is higher than the number of herds.

Table Salmonella serovars in food

Serovars		Meat from bovine animals		Meat from pig		Meat from broilers (Gallus gallus)		Other poultry		Other products of animal origin	
Sources of isolates (*)		M	C	M	C	M	C	M	C	M	C
Number of isolates in the laboratory	N=										
Number of isolates serotyped	N=	0	0	0	0	0	0	0	0	0	0

Footnote

(*) M : Monitoring, C : Clinical

Table Salmonella Enteritidis phagetypes in food

Phagetype		Meat from bovine animals		Meat from pig		Meat from broilers (Gallus gallus)		Other poultry		Other products of animal origin	
Sources of isolates (*)		M	C	M	C	M	C	M	C	M	C
Number of isolates in the laboratory	N=										
Number of isolates phagetyped	N=	0	0	0	0	0	0	0	0	0	0

Footnote

(*) M : Monitoring, C : Clinical

Table Salmonella Enteritidis phagetypes in humans

Phagetype		humans	
Sources of isolates (*)		M	C
Number of isolates in the laboratory	N=		
Number of isolates phagetyped	N=	0	0

Footnote

(*) M : Monitoring, C : Clinical

Table Salmonella Typhimurium phagetypes in animals

Phagetype		Cattle (bovine animals)		Pigs		Gallus gallus (fowl)		Other poultry	
Sources of isolates (*)		M	C	M	C	M	C	M	C
Number of isolates in the laboratory	N=	2	4	5	2				
Number of isolates phagetyped	N=	2	4	5	2	0	0	0	0
Number of isolates per type									
DT 104			1		1				
DT 120				1	1				
Not typable		2	2	1					
DT 40				3					
DT 41									
DT 10			1						
other									

Footnote

(*) M : Monitoring, C : Clinical
The outbreak in the broiler production was caused by S. Typhimurium NST and DT 120 (Gallus Gallus).

Table Salmonella Typhimurium phagetypes in food

Phagetype		Meat from bovine animals		Meat from pig		Meat from broilers (Gallus gallus)		Other poultry		Other products of animal origin	
Sources of isolates (*)		M	C	M	C	M	C	M	C	M	C
Number of isolates in the laboratory	N=										
Number of isolates phagetyped	N=	0	0	0	0	0	0	0	0	0	0

Footnote

(*) M : Monitoring, C : Clinical

Table Salmonella Typhimurium phagetypes in humans

Phagetype		humans	
Sources of isolates (*)		M	C
Number of isolates in the laboratory	N=		
Number of isolates phagetyped	N=	0	0

Footnote

(*) M : Monitoring, C : Clinical

2.1.7. Antimicrobial resistance in Salmonella isolates

Antimicrobial resistance is the ability of certain microorganisms to survive or grow in the presence of a given concentration of antimicrobial agent that usually would kill or inhibit the microorganism species in question. Antimicrobial resistant Salmonella strains may be transferred from animals or foodstuffs to humans.

A. Antimicrobial resistance in Salmonella in cattle

Sampling strategy used in monitoring

Frequency of the sampling

Antimicrobial susceptibility of Salmonella is monitored yearly within the Swedish Veterinary Antimicrobial Resistance Monitoring programme, SVARM. Isolates included derive from both active and passive salmonella monitoring programmes and from both clinical and non-clinical cases.

Type of specimen taken

For details on sampling see "Salmonella spp. in bovine animals".

Procedures for the selection of isolates for antimicrobial testing

It is mandatory that at least one isolate from each notified incident of Salmonella is confirmed at SVA. From these isolates, the first from each warm-blooded animal species from each notified incident is tested for antimicrobial susceptibility at the Department of Antibiotics, SVA.

Methods used for collecting data

All susceptibility tests are performed at SVA and the results are stored in an appropriate database.

Laboratory methodology used for identification of the microbial isolates

For details on culture see "Salmonella spp. in bovine animals".

Laboratory used for detection for resistance

Antimicrobials included in monitoring

For antimicrobials and ranges tested see Table "Breakpoints for antibiotic resistance testing of Salmonella in Animals".
Antimicrobial susceptibility was tested by a dilution method in cation adjusted Mueller-Hinton broth (CAMBH). The tests were performed following the standards for microdilution of the National Committee of Clinical Laboratory Standards (NCCLS, 2002) using VetMIC panels produced at the Dept. of Antibiotics, SVA. As quality control, Escherichia coli ATCC 25922 was included.
The Dept. of Antibiotics is accredited to perform the analyses by the Swedish Board for Accreditaion and Conformity Assesment (SWEDAC) according to SS-EN ISO/ IEC 17025 and

regularly participates in external quality assurance.

Breakpoints used in testing

For cut-off values (breakpoints) for resistance see Table "Breakpoints for antibiotic resistance testing of Salmonella in Animals".
Microbiological cut-off values recommended by the European Committee on Antimicrobial Susceptibility Testing (EUCAST) were used (http:/ / www.escmid.org). When no cut-off value was available (kanamycin, streptomycin, sulphonamide) a cut-off value was defined on basis of the actual MIC distributions obtained in the SVARM programme.

Preventive measures in place

See "Salmonella spp. in bovine animals".

Control program/ mechanisms

The control program/ strategies in place

See "Salmonella spp. in bovine animals".

Results of the investigation

Of the 21 incidents of Salmonella in cattle 2006 where antimicrobial susceptibility was tested, four incidents involved strains resistant to one or more antimicrobials.
One incident involved S.Typimurium DT104, with penta resistance (ampicillin/ chloramphenicol/ streptomycin/ sulpha/ tetracycline). Two incidents involved S.Tm NT resistant to four antimicrobials (ampicillin/ chloramphenicol/ streptomycin/ sulpha/ tetracycline) and one incident involved S.Tm DT104 resistant to ampicillin and sulphonamides.

National evaluation of the recent situation, the trends and sources of infection

The overall situation of antimicrobial resistance in Salmonella in cattle is favourable. There are few incidents each year and multiresistant clones are rarely involved. Furthermore there is no indication of spread of such clones among other animal species including wildlife.

B. Antimicrobial resistance in Salmonella in pigs

Sampling strategy used in monitoring

Frequency of the sampling

See "Antimicrobial resistance in Salmonella in cattle" for details.

Type of specimen taken

For details on sampling see "Salmonella spp. in pigs".

Laboratory methodology used for identification of the microbial isolates

For details on culture see "Salmonella spp. in pigs".

Laboratory used for detection for resistance

Antimicrobials included in monitoring

See "Antimicrobial resistance in Salmonella in cattle" for details.

Breakpoints used in testing

See "Antimicrobial resistance in Salmonella in cattle" for details.

Preventive measures in place

See "Salmonella spp. in pigs".

Control program/ mechanisms

The control program/ strategies in place

See "Salmonella spp. in pigs".

Results of the investigation

Of the 13 incidents of Salmonella in pigs 2006, where antimicrobial susceptibility was tested, only one incident involved resistant strains. The isolate was S.Typhimurium DT104 resistant to ampicillin/ streptomycin/ sulpha/ tetracycline).

National evaluation of the recent situation, the trends and sources of infection

The overall situation of antimicrobial resistance in Salmonella in pigs is favourable. Since the start of the monitoring programme SVARM year 2000, all 103 incidents except three has involved Salmonella sensitive to all antimicrobials tested. Of the resistant isolates, one was from 2000 (S. Tm DT12, resistant to nalidixic acid), one from 2005 (S. Typhimurium DT 104 resistant to ampicillin/ chloramphenicol/ streptomycin/ tetracycline/ sulpha) and one from 2006 (S.Tm DT 104 resistant to ampicillin/ streptomycin/ tetracycline/ sulpha).

C. Antimicrobial resistance in Salmonella in poultry

Sampling strategy used in monitoring

Frequency of the sampling

See "Antimicrobial resistance in Salmonella in cattle" for details.

Type of specimen taken

For details on sampling see "Salmonella spp. in poultry".

Methods of sampling (description of sampling techniques)

For details on sampling see "Salmonella spp. in poultry".

Procedures for the selection of isolates for antimicrobial testing

See "Antimicrobial resistance in Salmonella in cattle" for details.

Laboratory methodology used for identification of the microbial isolates

For details on culture see "Salmonella spp. in poultry".

Laboratory used for detection for resistance

Antimicrobials included in monitoring

See "Antimicrobial resistance in Salmonella in cattle" for details.

Breakpoints used in testing

See "Antimicrobial resistance in Salmonella in cattle" for details.

Preventive measures in place

See "Salmonella spp. in poultry".

Control program/ mechanisms

The control program/ strategies in place

See "Salmonella spp. in poultry".

Recent actions taken to control the zoonoses

See "Salmonella spp. in poultry".

National evaluation of the recent situation, the trends and sources of infection

The overall situation of antimicrobial resistance in Salmonella in poultry is favourable. Of the isolates from the 48 reported incidents since the start of the monitoring programme SVARM year 2000, only two have been resistant to any of the tested antimicrobials. In 2003 an isolate of S. Typhimurium DT 15a was resistant to sulphonamides and streptomycin and in 2000, an isolate of S. spp. was resistant to sulphonamides.

Table Antimicrobial susceptibility testing of S. Dublin in Cattle (bovine animals) - in total - Control or eradication programmes - quantitative data [Dilution method]

Number of resistant isolates (n) and number of isolates with the concentration µl/ ml) or zone (mm) of inhibition equal to																						
	S. Dublin																					
	Cattle (bovine animals) - in total - Control or eradication programmes																					
Isolates out of a monitoring programme	yes																					
Number of isolates available in the laboratory	10																					
Antimicrobials:	**N**	**n**	**<=0.03**	**0.06**	**0.12**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**>2048**	**lowest**	**highest**
Tetracyclines																						
Tetracyclin	10	0						6	4												0.5	64
Amphenicols																						
Chloramphenicol	10	0							6	4											1	128
Florfenicol	10	0								10											4	32
Cephalosporins																						
3rd generation cephalosporins	0	0																				
Cefotaxim	10	0		6	3	1															0.06	2
Ceftiofur	10	0			1	6	2	1													0.12	16
Fluoroquinolones																						
Ciprofloxacin	10	0	5	5																	0.008	1
Enrofloxacin	0	0																				
Quinolones																						
Nalidixic acid	10	0								6	4										1	128
Sulfonamides																						
Sulfonamide	10	0											4	4	2						16	2048
Trimethoprim	10	0				1	6	2	1												0.25	32
Aminoglycosides																						
Streptomycin	10	0									2	4	4								2	256
Gentamicin	10	0					5	5													0.5	64
Neomycin	0	0																				
Kanamycin	10	0							3	6	1										2	16
Penicillins																						
Ampicillin	10	0					3	3	4												0.25	32
Trimethoprim + sulfonamides	0	0																				

Table Antimicrobial susceptibility testing of S.Enteritidis in animals

n = Number of resistant isolates	S. Enteritidis							
	Cattle (bovine animals)		**Pigs**		**Gallus gallus (fowl)**		**Turkeys**	
Isolates out of a monitoring programme	yes		yes		yes		yes	
Number of isolates available in the laboratory	0		0		0		0	
Antimicrobials:	**N**	**n**	**N**	**n**	**N**	**n**	**N**	**n**

Footnote

No isolates of S. Enteritidis in 2006.

Table Antimicrobial susceptibility testing of S.Typhimurium in animals

n = Number of resistant isolates

S. Typhimurium

	Cattle (bovine animals)		Pigs		Gallus gallus (fowl)		Turkeys	
Isolates out of a monitoring programme	yes		yes		yes		yes	
Number of isolates available in the laboratory	7		8		4		0	
Antimicrobials:	**N**	**n**	**N**	**n**	**N**	**n**	**N**	**n**
Tetracyclines								
Tetracyclin	7	3	8	0	4	0	0	0
Amphenicols								
Chloramphenicol	7	1	8	0	4	0	0	0
Florfenicol	7	1	8	0	4	0	0	0
Cephalosporins								
Cefotaxim	7	0	8	0	4	0	0	0
Ceftiofur	7	0	8	0	4	0	0	0
Fluoroquinolones								
Ciprofloxacin	7	0	8	0	4	0	0	0
Quinolones								
Nalidixic acid	7	0	8	0	4	0	0	0
Sulfonamides								
Sulfonamide	7	4	8	1	4	0	0	0
Trimethoprim	7	0	8	0	4	0	0	0
Aminoglycosides								
Streptomycin	7	3	8	0	4	0	0	0
Gentamicin	7	0	8	0	4	0	0	0
Kanamycin	7	0	8	0	4	0	0	0
Penicillins								
Ampicillin	7	4	8	1	4	0	0	0
Fully sensitive	7	3	8	7	4	4	0	0
Resistant to 1 antimicrobial	7	0	8	0	4	0	0	0
Resistant to 2 antimicrobials	7	1	8	1	4	0	0	0
Resistant to 3 antimicrobials	7	0	8	0	4	0	0	0
Resistant to 4 antimicrobials	7	2	8	0	4	0	0	0
Resistant to >4 antimicrobials	7	1	8	0	4	0	0	0
Number of multiresistant S. Typhimurium DT104								
with penta resistance	2	1	1	0	0	0	0	0
resistant to other antimicrobials	2	1	1	1	0	0	0	0

Table Antimicrobial susceptibility testing of S. Typhimurium in Cattle (bovine animals) - in total - Control or eradication programmes - quantitative data [Dilution method]

Number of resistant isolates (n) and number of isolates with the concentration µl/ ml) or zone (mm) of inhibition equal to

S. Typhimurium

Cattle (bovine animals) - in total - Control or eradication programmes

Isolates out of a monitoring programme	yes
Number of isolates available in the laboratory	7

Antimicrobials:	**N**	**n**	**<=0.03**	**0.06**	**0.12**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**>2048**	**lowest**	**highest**
Tetracyclines																						
Tetracyclin	7	3							4			1			2						0.5	64
Amphenicols																						
Chloramphenicol	7	1							1	2	3					1					1	128
Florfenicol	7	1								6			1								4	32
Cephalosporins																						
3rd generation cephalosporins	0	0																				
Cefotaxim	7	0			3	4															0.06	2
Ceftiofur	7	0					3	3	1												0.12	16
Fluoroquinolones																						
Ciprofloxacin	7	0		7																	0.008	1
Enrofloxacin	0	0																				
Quinolones																						
Nalidixic acid	7	0								7											1	128
Sulfonamides																						
Sulfonamide	7	4													2	1			4		16	2048
Trimethoprim	7	0				3	4														0.25	32
Aminoglycosides																						
Streptomycin	7	3										3	1		1	2					2	256
Gentamicin	7	0						7													0.5	64
Neomycin	0	0																				
Kanamycin	7	0								6	1										2	16
Penicillins																						
Ampicillin	7	4						1	2					4							0.25	32
Trimethoprim + sulfonamides	0	0																				

Table Antimicrobial susceptibility testing of S. Typhimurium in Pigs - in total - Control or eradication programmes - quantitative data [Dilution method]

Number of resistant isolates (n) and number of isolates with the concentration µl/ ml) or zone (mm) of inhibition equal to

S. Typhimurium

Pigs - in total - Control or eradication programmes

Isolates out of a monitoring programme	yes
Number of isolates available in the laboratory	8

Antimicrobials:	**N**	**n**	**<=0.03**	**0.06**	**0.12**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**>2048**	**lowest**	**highest**
Tetracyclines																						
Tetracyclin	8	0						2	6												0.5	64
Amphenicols																						
Chloramphenicol	8	0							1	7											1	128
Florfenicol	8	0								7	1										4	32
Cephalosporins																						
3rd generation cephalosporins	0	0																				
Cefotaxim	8	0		1	4	3															0.06	2
Ceftiofur	8	0					1	7													0.12	16
Fluoroquinolones																						
Ciprofloxacin	8	0	2	6																	0.008	1
Enrofloxacin	0	0																				
Quinolones																						
Nalidixic acid	8	0								6	2										1	128
Sulfonamides																						
Sulfonamide	8	1												3	1	3				1	16	2048
Trimethoprim	8	0				2	3	3													0.25	32
Aminoglycosides																						
Streptomycin	8	0									1	7									2	256
Gentamicin	8	0					1	6	1												0.5	64
Neomycin	0	0																				
Kanamycin	8	0								7	1										2	16
Penicillins																						
Ampicillin	8	1						2	3	2				1							0.25	32
Trimethoprim + sulfonamides	0	0																				

Table Antimicrobial susceptibility testing of S. Typhimurium in Gallus gallus (fowl) - in total - Control or eradication programmes - quantitative data [Dilution method]

Number of resistant isolates (n) and number of isolates with the concentration µl/ ml) or zone (mm) of inhibition equal to																						
	S. Typhimurium																					
	Gallus gallus (fowl) - in total - Control or eradication programmes																					
Isolates out of a monitoring programme	yes																					
Number of isolates available in the laboratory	4																					
Antimicrobials:	**N**	**n**	**<=0.03**	**0.06**	**0.12**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**>2048**	**lowest**	**highest**
Tetracyclines																						
Tetracyclin	4	0							4												0.5	64
Amphenicols																						
Chloramphenicol	4	0								2	2										1	128
Florfenicol	4	0								2	2										4	32
Cephalosporins																						
3rd generation cephalosporins	0	0																				
Cefotaxim	4	0			2	2															0.06	2
Ceftiofur	4	0						4													0.12	16
Fluoroquinolones																						
Ciprofloxacin	4	0	1	3																	0.008	1
Enrofloxacin	0	0																				
Quinolones																						
Nalidixic acid	4	0								4											1	128
Sulfonamides																						
Sulfonamide	4	0													4						16	2048
Trimethoprim	0	0																			0.25	32
Aminoglycosides																						
Streptomycin	4	0										4									2	256
Gentamicin	4	0						4													0.5	64
Neomycin	0	0																				
Kanamycin	4	0								3	1										2	16
Penicillins																						
Ampicillin	4	0						1	3												0.25	32
Trimethoprim + sulfonamides	0	0																				

Table Antimicrobial susceptibility testing of S. Species in Gallus gallus (fowl) - in total - Control or eradication programmes - quantitative data [Dilution method]

Number of resistant isolates (n) and number of isolates with the concentration µl/ ml) or zone (mm) of inhibition equal to																						
	S. Species																					
	Gallus gallus (fowl) - in total - Control or eradication programmes																					
Isolates out of a monitoring programme	yes																					
Number of isolates available in the laboratory	4																					
Antimicrobials:	**N**	**n**	**<=0.03**	**0.06**	**0.12**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**>2048**	**lowest**	**highest**
Tetracyclines																						
Tetracyclin	4	0						1	3												0.5	64
Amphenicols																						
Chloramphenicol	4	0								1	3										1	128
Florfenicol	4	0								1	3										4	32
Cephalosporins																						
3rd generation cephalosporins	0	0																				
Cefotaxim	4	0			1	3															0.06	2
Ceftiofur	4	0					2	2													0.12	16
Fluoroquinolones																						
Ciprofloxacin	4	0		4																	0.008	1
Enrofloxacin	0	0																				
Quinolones																						
Nalidixic acid	4	0								3	1										1	128
Sulfonamides																						
Sulfonamide	4	0											1	2	1						16	2048
Trimethoprim	4	0				1	3														0.25	32
Aminoglycosides																						
Streptomycin	4	0									1	1	2								2	256
Gentamicin	4	0						1	3												0.5	64
Neomycin	0	0																				
Kanamycin	4	0								2	2										2	16
Penicillins																						
Ampicillin	4	0						1	2	1											0.25	32
Trimethoprim + sulfonamides	0	0																				

Footnote

One isolate each of the serovars S.Agona, S.Senftenberg, S.Worthington, S.Rubislaw

Table Antimicrobial susceptibility testing of S. Species in Pigs - in total - quantitative data [Dilution method]

Number of resistant isolates (n) and number of isolates with the concentration µl/ ml) or zone (mm) of inhibition equal to																						
	S. Species																					
	Pigs - in total																					
Isolates out of a monitoring programme	yes																					
Number of isolates available in the laboratory	5																					
Antimicrobials:	**N**	**n**	**<=0.03**	**0.06**	**0.12**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**>2048**	**lowest**	**highest**
Tetracyclines																						
Tetracyclin	5	0						2	3												0.5	64
Amphenicols																						
Chloramphenicol	5	0								4	1										1	128
Florfenicol	5	0								2	3										4	32
Cephalosporins																						
3rd generation cephalosporins	0	0																				
Cefotaxim	5	0		1	1	3															0.06	2
Ceftiofur	5	0					1	4													0.12	16
Fluoroquinolones																						
Ciprofloxacin	5	0	2	3																	0.008	1
Enrofloxacin	0	0																				
Quinolones																						
Nalidixic acid	5	0								4	1										1	128
Sulfonamides																						
Sulfonamide	5	0												2	3						16	2048
Trimethoprim	5	0				2	3														0.25	32
Aminoglycosides																						
Streptomycin	5	0									1	3	1								2	256
Gentamicin	5	0					2	2	1												0.5	64
Neomycin	0	0																				
Kanamycin	5	0								5											2	16
Penicillins																						
Ampicillin	5	0					2		3												0.25	32
Trimethoprim + sulfonamides	0	0																				

Footnote

Three isolates of S.Agona, 1 S. Baenderup, 1 S. Oranienburg

Table Antimicrobial susceptibility testing of Salmonella in animals

n = Number of resistant isolates	Salmonella spp.							
	Cattle (bovine animals)		**Pigs**		**Gallus gallus (fowl)**		**Turkeys**	
Isolates out of a monitoring programme	yes		yes		yes		yes	
Number of isolates available in the laboratory	14		5		4		0	
Antimicrobials:	**N**	**n**	**N**	**n**	**N**	**n**	**N**	**n**
Tetracyclines								
Tetracyclin	14	0	5	0	4	0	0	0
Amphenicols								
Chloramphenicol	14	0	5	0	4	0	0	0
Florfenicol	14	0	5	0	4	0	0	0
Cephalosporins								
Cefotaxim	14	0	5	0	4	0	0	0
Ceftiofur	14	0	5	0	4	0	0	0
Fluoroquinolones								
Ciprofloxacin	14	0	5	0	4	0	0	0
Quinolones								
Nalidixic acid	14	0	5	0	4	0	0	0
Sulfonamides								
Sulfonamide	14	0	5	0	4	0	0	0
Trimethoprim	14	0	5	0	4	0	0	0
Aminoglycosides								
Streptomycin	14	0	5	0	4	0	0	0
Gentamicin	14	0	5	0	4	0	0	0
Kanamycin	14	0	5	0	4	0	0	0
Penicillins								
Ampicillin	14	0	5	0	4	0	0	0
Fully sensitive	14	14	5	5	4	4	0	0
Resistant to 1 antimicrobial	14	0	5	0	4	0	0	0
Resistant to 2 antimicrobials	14	0	5	0	4	0	0	0
Resistant to 3 antimicrobials	14	0	5	0	4	0	0	0
Resistant to 4 antimicrobials	14	0	5	0	4	0	0	0
Resistant to >4 antimicrobials	14	0	5	0	4	0	0	0

Footnote

Salmonella serovars other than S. Typhimurium

Table Antimicrobial susceptibility testing of Salmonella spp. in Cattle (bovine animals) - in total - Control or eradication programmes - quantitative data [Dilution method]

Number of resistant isolates (n) and number of isolates with the concentration µl/ ml) or zone (mm) of inhibition equal to																						
	Salmonella spp.																					
	Cattle (bovine animals) - in total - Control or eradication programmes																					
Isolates out of a monitoring programme	yes																					
Number of isolates available in the laboratory	4																					
Antimicrobials:	**N**	**n**	**<=0.03**	**0.06**	**0.12**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**>2048**	**lowest**	**highest**
Tetracyclines																						
Tetracyclin	4	0						1	3												0.5	64
Amphenicols																						
Chloramphenicol	4	0							1	1	2										1	128
Florfenicol	4	0								2	2										4	32
Cephalosporins																						
3rd generation cephalosporins	0	0																				
Cefotaxim	4	0			1	3															0.06	2
Ceftiofur	4	0					1	3													0.12	16
Fluoroquinolones																						
Ciprofloxacin	4	0		4																	0.008	1
Enrofloxacin	0	0																				
Quinolones																						
Nalidixic acid	4	0								2	2										1	128
Sulfonamides																						
Sulfonamide	4	0												2	2						16	2048
Trimethoprim	0	0																			0.25	32
Aminoglycosides																						
Streptomycin	4	0									1	2	1								2	256
Gentamicin	4	0						4													0.5	64
Neomycin	0	0																				
Kanamycin	4	0								4											2	16
Penicillins																						
Ampicillin	4	0						1	3												0.25	32
Trimethoprim + sulfonamides	0	0																				

Footnote

One isolate of S.Agona, S.Livingstone, S.Duesseldorf S.Tomphson, respectively.

Table Breakpoints for antibiotic resistance testing in Animals

Test Method Used

Disc diffusion

Agar dilution

Broth dilution

E-test

Standards used for testing

NCCLS

Salmonella	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Amphenicols										
Chloramphenicol	EUCAST	16		16	1	128				
Florfenicol	EUCAST	16		16	4	32				
Tetracyclines										
Tetracyclin	EUCAST	8		8	0.5	64				
Fluoroquinolones										
Ciprofloxacin	EUCAST	0.06		0.06	0.008	1				
Enrofloxacin										
Quinolones										
Nalidixic acid	EUCAST	16		16	1	128				
Trimethoprim	EUCAST	2		2	0.25	32				
Sulfonamides										
Sulfonamide	NCCLS	256		256	16	2048				
Aminoglycosides										
Streptomycin	no standard available	32		32	2	256				
Gentamicin	EUCAST	2		2	0.5	64				
Neomycin										
Kanamycin	no standard available	16		16	2	16				
Trimethoprim + sulfonamides										
Cephalosporins										
Cefotaxim	EUCAST	0.5		0.5	0.06	2				
Ceftiofur	EUCAST	2		2	0.12	16				
3rd generation cephalosporins										
Penicillins										
Ampicillin	EUCAST	4		4	0.25	32				

Table Breakpoints for antibiotic resistance testing in Food

Test Method Used

- Disc diffusion
- Agar dilution
- Broth dilution
- E-test

Standards used for testing

Salmonella	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Amphenicols										
Chloramphenicol										
Florfenicol										
Tetracyclines										
Tetracyclin										
Fluoroquinolones										
Ciprofloxacin										
Enrofloxacin										
Quinolones										
Nalidixic acid										
Trimethoprim										
Sulfonamides										
Sulfonamide										
Aminoglycosides										
Streptomycin										
Gentamicin										
Neomycin										
Kanamycin										
Trimethoprim + sulfonamides										
Cephalosporins										
Cefotaxim										
Ceftiofur										
3rd generation cephalosporins										
Penicillins										
Ampicillin										

Table Breakpoints for antibiotic resistance testing in Feedingstuff

Test Method Used

- Disc diffusion
- Agar dilution
- Broth dilution
- E-test

Standards used for testing

Salmonella	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Amphenicols										
Chloramphenicol										
Florfenicol										
Tetracyclines										
Tetracyclin										
Fluoroquinolones										
Ciprofloxacin										
Enrofloxacin										
Quinolones										
Nalidixic acid										
Trimethoprim										
Sulfonamides										
Sulfonamide										
Aminoglycosides										
Streptomycin										
Gentamicin										
Neomycin										
Kanamycin										
Trimethoprim + sulfonamides										
Cephalosporins										
Cefotaxim										
Ceftiofur										
3rd generation cephalosporins										
Penicillins										
Ampicillin										

Table Breakpoints for antibiotic resistance testing in Humans

Test Method Used

- Disc diffusion
- Agar dilution
- Broth dilution
- E-test

Standards used for testing

Salmonella	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Amphenicols										
Chloramphenicol										
Florfenicol										
Tetracyclines										
Tetracyclin										
Fluoroquinolones										
Ciprofloxacin										
Enrofloxacin										
Quinolones										
Nalidixic acid										
Trimethoprim										
Sulfonamides										
Sulfonamide										
Aminoglycosides										
Streptomycin										
Gentamicin										
Neomycin										
Kanamycin										
Trimethoprim + sulfonamides										
Cephalosporins										
Cefotaxim										
Ceftiofur										
3rd generation cephalosporins										
Penicillins										
Ampicillin										

2.2. CAMPYLOBACTERIOSIS

2.2.1. General evaluation of the national situation

A. Thermophilic Campylobacter general evaluation

History of the disease and/ or infection in the country

From 1991 to June 2001, a voluntary Campylobacter programme was run. During this period the prevalence varied between 9 and 16%. Between July 2001 and Dec 2005, a new and more sampling intensive programme was implemented. In this programme the flock prevalence increased up to 20%. It is likely that the increase was due changes in sampling strategy and bacteriological analyses. However, between 2001-05 there was a decreasing trend of positive slaughter groups from 20-14%.
From 1995 to 2006, the number of reported domestic cases varied between 1781 and 2839, with the lowest number reported in 2006. Approximately 30-45% of the total number of cases are of domestic origin.

National evaluation of the recent situation, the trends and sources of infection

Campylobacteriosis is the most commonly reported zoonotic infection in Sweden, as in the rest of the EU. As 30-45% of the cases in Sweden are of domestic origin it is important to implement measures to reduce the incidence, an example of this is the Campylobacter programme. Since 2003, there has been a decreasing trend of reported human cases with the lowest number of notifications in 2006 during the last decade.
During the campylobacter programme 2001-2005, there was a decreaing trend in number of positive slaughter groups.
There is a marked seasonal variation both in broilers and human cases, although the peak in human campylobacteriosis precedes the peak reported in broilers.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

Consumption of poultry meat is regarded as an important source of infection for human campylobacteriosis. However, case-control studies have also shown other risk factors for domestic campylobacteriosis, for example consumption of unpasteurised milk, barbeque and contact with dogs. Several waterborne outbreaks have also been reported in Sweden.

Suggestions to the Community for the actions to be taken

One important action is to implement a harmonised monitoring programme in poultry. The work that has started in this area should proceed. With an increasing trade within the EU, Campylobacter appears to be a Community problem, requiring a Community solution.

2.2.2. Campylobacteriosis in humans

A. Thermophilic Campylobacter in humans

Reporting system in place for the human cases

Surveillance is based on passive case findings.

Case definition

A positive case is defined as a person from whom Campylobacter has been isolated.

Diagnostic/ analytical methods used

Cultivation from stool sample and blood.

Notification system in place

Campylobacteriosis is notifiable under the Communicable Disease Act (both from the laboratory and from the physician).

History of the disease and/ or infection in the country

Infection with Campylobacter became notifiable in 1989. From 1995 to 2006, the total number of cases reported have varied between 5119 to 8578, with the highest figure in 2001. During the same time period the number of reported domestic cases varied between 1781 and 2839. Since 2003, there has been a decreasing trend of reported domestic cases with the lowest number of notifications during the last decade in 2006. Approximately 30-45% of the total number of cases are of domestic origin.

Results of the investigation

During 2006, a total of 6078 cases of campylobacteriosis were reported, which was a decrease compared to 2005 (11%). Also among the domestic cases the decrease was considerable, 20%. The decrease was evenly distributed throughout the country, except for in two counties, where an increase was reported.
Of the domestic cases 11% were reported in the age group 0-4 years and in most age groups men dominated.

National evaluation of the recent situation, the trends and sources of infection

There is a peak of cases (both among domestic cases and cases acquired abroad) during the summer months. Reasons for this are unknown, but it can be speculated that increased outdoor activities play a role. Increased travelling also leads to increased number of cases acquired abroad.
Food and water are the most commonly cited sources of infections at the clinical reports.

Relevance as zoonotic disease

A significant part (30-45 %) of the cases of campylobacteriosis are domestic. It is unknown how many of those that are caused by consumption of poultry. It needs to be investigated how effective it would be to implement measures in order to reduce the prevalence of Campylobacter in broilers, and which measure that would be most effective.

2.2.3. Campylobacter in foodstuffs

A. Thermophilic Campylobacter in Broiler meat and products thereof

Monitoring system

Sampling strategy

At slaughterhouse and cutting plant

Industry decides. No reporting to the authorities is requested.

At meat processing plant

See above.

At retail

No special sampling strategy is used by the local authorities.
Sampling is very infrequent.

Frequency of the sampling

At slaughterhouse and cutting plant

Other: Infrequent sampling.

At meat processing plant

Other: Infrequent sampling.

At retail

Other: Infrequent sampling.

Type of specimen taken

At slaughterhouse and cutting plant

Other: No information available.

At meat processing plant

Other: No information available.

At retail

Other: Varies, mostly meat products.

Methods of sampling (description of sampling techniques)

At slaughterhouse and cutting plant

No information available.

At meat processing plant

No information available.

At retail

No information available.

Definition of positive finding

At retail

Campylobacter identified in the sample.

Diagnostic/ analytical methods used

At retail

Bacteriological method: NMKL 119: 1990

Control program/ mechanisms

Suggestions to the Community for the actions to be taken

A food safety objective (FSO) should be established, e.g. <1000 Camp./ g.

Measures in case of the positive findings or single cases

Campylobacter found in products that will be consumed without further heat-treatment is considered as unfit for consumption.

Notification system in place

None.

Results of the investigation

In 2006, local health authorities reported 7 samples of fresh poultry meat and 16 samples of poultry meat products taken at retail.
However, no results were reported (For results from sampling of poultry meat at slaughter, see "Campylobacter in animals".)

National evaluation of the recent situation, the trends and sources of infection

Poultry products are still considered to be an important source of human infection.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

Campylobacter in poultry is relevant both to findings in poultry meat and products thereof as well as to human cases.

Additional information

19 local authorities have reported altogether 266 Campylobacter samples taken in official control during 2006. Of these 157 were samples of ready-to -eat food (not specified) 14 vegetables, 23 poultry meat and products, 58 red meat and products thereof, 5 eggs and eggsproducts. The remaining samples are not specified. One sample of ready -to -eat -foods were found unfit for human consumption due to Campylobacter load.

2.2.4. Campylobacter in animals

A. Thermophilic Campylobacter in Gallus gallus

Monitoring system

Sampling strategy

In the Campylobacter programme, all flocks of broilers are examined for Campylobacter at the slaughterhouse. The program includes all members of Swedish Poultry Meat Association (SPMA, Svensk Fagel) and some of the non-members and is financed by the Swedish Board of Agriculture (SJV) and the SPMA.
SINGLE STUDIES:
1) A study was conducted to investigate the variation of Campylobacter load witin a flock. Samples were collected at slaughter.
2) Another study was performed with the aim to analyse the Campylobacter load in relation to when the broilers get colonised. Samples were collected at farm level and at slaughter.

Frequency of the sampling

At slaughter

Other: Every slaughter group is sampled

Type of specimen taken

At slaughter

Other: caecum samples

Methods of sampling (description of sampling techniques)

At slaughter

FROM EACH SLAUGHTER GROUP:
Ten caeca are taken from ten birds per slaughter group and pooled to form one composite sample.
SINGLE STUDIES
1) Twenty-nine flocks were sampled at farm level prior to slaughter, 10 caeca and 5 to 25 carcasses per flock were collected at slaughter. Each carcass was individually rinsed in 400 ml buffered peptone water and the number of Campylobacter cfu per ml rinse fluid was calculated.
2) From 220 flocks, sock samples were collected one week before slaughter and on the same day as transport to slaughter. From each flock one carcass rinse samples was analysed.

Case definition

Rearing period

At farm level, a case is defined as a flock that tested positive for thermophilic

Campylobacter in a sock sample. The epidemiological unit is the flock.

Before slaughter at farm

See "Rearing priod"

At slaughter

At farm level, a case is defined as a slaughtered group that tested positive for thermophilic Campylobacter in a cloacal sample. The epidemiological unit is the slaughtered group

Diagnostic/ analytical methods used

Rearing period

Bacteriological method: NMKL 119:1990

Before slaughter at farm

Bacteriological method: NMKL 119:1990

At slaughter

Bacteriological method: ISO/ TS 10272-1

Vaccination policy

Other preventive measures than vaccination in place

Preventive measures at primary production are hygiene barriers, cleaning and disinfection after slaughter of each flock and leaving the stable empty for a defined period before introducing a new flock. Specific advices to each producer is also given by the SPMA. The majority of the slaughter companies pay extra for Campylobacter free broilers, as a bonus to encourage efforts to reduce the introduction of Campylobacter into the broiler flocks.

Control program/ mechanisms

The control program/ strategies in place

In the current monitoring programme of Campylobacter in broilers all flocks are sampled at slaughter. The programme is voluntary and financed by the SPMA and the SJV.
The SPMA covers the entire production chain, from feed manufacturers, breeding companies, hatcheries, broiler producers, abattoirs and processing plants. Members of the SPMA produce approximately 99% of all broilers slaughtered in Sweden. The members are obliged to only use approved feed and to participate in stipulated animal health programs, such as Salmonella, welfare and classification program.

Measures in case of the positive findings or single cases

If a flock is found positive, stricter hygiene measures should be implemented in order to clean-up the stable where the broilers have been kept from colonization.

Notification system in place

In poultry, Campylobacter infection is not notifiable. However, results from the Campylobacter programme are available from the SPMA.

Results of the investigation

From the producers affiliated to the SPMA 328 (13%) out of 2486 slaughter groups were positive for Campylobacter. From 86 slaughter groups not affiliated to the control programme 28 (33%) were positive.
SINGLE STUDIES:
1) Campylobacter was detected in carcasses from 22 flocks, out of 29 sampled. The 22 flocks had also been positive at farm level. From 7 positive flocks, 1 to 3 carcasses were negative, i.e. there was no Campylobacter above the detection limit of 1 cfu/ ml rinse fluid. The Campylobacter load within a flock varied between 1.0- 3.2 log cfu/ ml carcass rinse fluid, which shows that it is difficult to decide the level of contamination in a flock if only one carcass is examined.
2) One carcass rinse sample was analysed from each of 220 flocks. From those flocks, campylobacter was found in 22% of the flocks sampled by sock samples one week before slaughter and in 36% of the flocks sampled on the same day as transport to slaughter. No difference was found in campylobacter load in carcass rinse samples between flocks that were colonised in the last days before slaughter compared with those colonised at least one week before slaughter. However, those flocks where campylobacter was only found in carcass rinse samples and not at farm level or caecal samples at slaughter had a significantly lower campylobacter incidence. These results confirm that campylobacter are often introduced during the last week prior to slaughter and logistic slaughter based on samples taken 1-2 weeks before slaughter is of limited value because most flocks become colonised during their last week.

National evaluation of the recent situation, the trends and sources of infection

From 2001-2005, the number of Campylobacter positive slaughter groups decreased (including cloacal- and neck skin samples). Results from 2006 were similar to those obtained in 2005. The decreasing trend could be due to increased awareness of the farmer about the importance of hygienic barriers.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

Consumption of poultry meat is regarded an important source of domestically aquired Campylobacter infection in humans, even if there are also other sources of importance.

Additional information

Between 1991 and June 2001, a Campylobacter monitoring programme was run by the industry SPMA. During that period the prevalence varied between 9 and 16%. Between 1 July 2001 and 21 December 2005 a new and more sampling intensive Campylobacter programme was run. The program was voluntary, financed by the SPMA and SJV, with additional funding from the European Commission and run by the SPMA, SJV, SLV, SVA and SMI.
Studies within the programme have shown that about one third of the producers seldom delivered campylobacter-positive slaughter batches. A seasonal variation with higher prevalence of Campylobacter infection in broiler flocks during late summer and early autumn has been observed.

In 2002 it was shown that in one fifth of the flocks the within flock prevalence was considerable lower than 100%.
In 2003, a study showed that the majority of positive flocks were infected during the last week before slaughter.
In 2004, it was shown that there was no difference in findings of Campylobacter outside the stables between different producers that often or seldomly deliver Campylobacter positive slaughter groups.
In 2005, two qualitative studies were conducted to compare different samples at farm level and at slaughter. Furthermore, a quantitative study was carried out on neck skin and whole carcass rinse samples

Table Campylobacter in animals

	Source of information	Sampling unit	Units tested	Total units positive for thermophilic Campylobacter spp.	C. jejuni	C. coli	C. lari	C. upsaliensis	thermophilic Campylobacter spp., unspecified
Gallus gallus (fowl)									
broilers									
- at slaughterhouse (1)	SVA, SPMA	slaughter batch	2572	356					

(1) : Approximately 95% of the isolates are C. jejuni.

Footnote

Flocks associated to the Swedish Poultry Meat Association (svensk fagel): 328/ 2486 (13%) positive slaughter groups.
Flocks not associated to the SPMA: 28/ 68 (33%) positive slaughter groups.

2.2.5. Antimicrobial resistance in Campylobacter isolates

A. Antimicrobial resistance in Campylobacter jejuni and coli in cattle

Sampling strategy used in monitoring

Frequency of the sampling

Antimicrobial resistance in Campylobacter from different animal species is regularly monitored in the Swedish Veterinary Antimicrobial Resistance Monitoring Programme, SVARM. In 2006, isolates from dairy cows were tested.

Type of specimen taken

Intestinal content (caecum or colon) from dairy cows were sampled at slaughter. Each animal is from a unique dairy herd.

Methods of sampling (description of sampling techniques)

In all 460 samples were collected from 11 abattoirs. The abattoirs account for 84% of the total volume of dairy cows slaughtered in Sweden in 2005. The number of samples collected at each abattoir was proportional to the slaughter volume of the abattoir.

Procedures for the selection of isolates for antimicrobial testing

All isolates (68) obtained from culture of the 470 samples were tested for antimicrobial susceptibility. Each isolate is from a unique dairy herd.

Methods used for collecting data

Results of antimicrobial susceptibilty testing and information on origin of isolates were stored in a database at SVA. For compiling statistics, relevant data were extracted from the database.

Laboratory methodology used for identification of the microbial isolates

Campylobacter spp. were isolated and identified at SVA according to standard procedures. Briefly, samples were cultured for thermophilic Campylobacter spp. by a modified NMKL method (NMKL Nr 119, 1990) using enrichment in Preston broth followed by culture on Preston selective agar and incubation at 42°C. Identification was based on colony morphology, microscopic appearance including motility and the following phenotypic characteristics: production of oxidase, catalase, hippurate hydrolysis reaction and indoxyl-actetate reaction (Nachamkin, 1999). With these tests, hippurate-positive C. jejuni can be identified whereas other isolates are described as hippurate-negative thermophilic Campylobacter spp.

Laboratory used for detection for resistance

Antimicrobials included in monitoring

Antimicrobial susceptibility testing of Campylobacter from animals was performed at the Dept. of Antibiotics, SVA using a microdilution method according to NCCLS guidlines.
For antimicrobials tested and breakpoints used see table "Breakpoints used for antimicrobial

susceptibility testing in Animals".

Preventive measures in place

No preventive measures regarding antimicrobial resistance in Campylobacer from animals are in place.

Control program/ mechanisms

The control program/ strategies in place

No control programme for antimicrobial resistance in Campylobacter from cattle is in place.

Measures in case of the positive findings or single cases

No specific measures are taken in case of resistance in Campylobacter from cattle.

Notification system in place

No notification system is in place

Results of the investigation

Of the 68 isolates of C. jejuni tested no isolate was resistant to erythromycin, gentamicin or tetracycline. One isolate was resistant to ampicilin and 5 and 6 isolates to enrofloxacin and nalidixic acid, respectively.

National evaluation of the recent situation, the trends and sources of infection

The results of the present study on Campylobacter jejuni from dairy cows are similar to the results of a study on isolates from yearling cattle performed in 1999-00. Resistance is overall rare and no isolate has been resistant to erythromycin, the antimicrobial commonly used to treat infections in human. The small number of isolates tested precludes valid conclusions on trends.

Table Antimicrobial susceptibility testing of C. jejuni - qualitative data

n = Number of resistant isolates		
	C. jejuni	
	Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring	
Isolates out of a monitoring programme	yes	
Number of isolates available in the laboratory	68	
Antimicrobials:	**N**	**n**
Tetracyclines		
Tetracyclin	68	0
Fluoroquinolones		
Enrofloxacin	68	5
Quinolones		
Nalidixic acid	68	6
Aminoglycosides		
Gentamicin	68	0
Macrolides		
Erythromycin	68	0
Penicillins		
Ampicillin	68	1
Fully sensitive	68	61
Resistant to 1 antimicrobial	68	7

Footnote

Nalidixic acid and enrofloxacin regarded as one substance in calculation of multiresistance

Table Antimicrobial susceptibility testing of C. jejuni in Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring - quantitative data [Dilution method]

Number of resistant isolates (n) and number of isolates with the concentration µl/ ml) or zone (mm) of inhibition equal to																						
	C. jejuni																					
	Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring																					
Isolates out of a monitoring programme	yes																					
Number of isolates available in the laboratory	68																					
Antimicrobials:	**N**	**n**	**<=0.03**	**0.06**	**0.12**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**>2048**	**lowest**	**highest**
Tetracyclines																						
Tetracyclin	68	0				66		2													0.25	32
Fluoroquinolones																						
Ciprofloxacin	0	0																				
Enrofloxacin	68	5		3	39	14	7	1		2	2										0.06	4
Quinolones																						
Nalidixic acid	68	6								24	31	7		1	2	3					1	128
Aminoglycosides																						
Gentamicin	68	0				2	37	29													0.25	8
Macrolides																						
Erythromycin	68	0			1	4	28	29	4	2											0.12	16
Penicillins																						
Ampicillin	68	1					7	3	31	22	4			1							0.5	64

Table Breakpoints used for antimicrobial susceptibility testing in Animals

Test Method Used

Disc diffusion

Agar dilution

Broth dilution

E-test

Standards used for testing

NCCLS

Campylobacter	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Tetracyclines										
Tetracyclin	EUCAST	2		2	0.25	32				
Fluoroquinolones										
Ciprofloxacin										
Enrofloxacin	No standard available	0.5		0.5	0.03	4				
Quinolones										
Nalidixic acid	EUAST	16		16	1	128				
Aminoglycosides										
Gentamicin	EUCAST	1		1	0.25	8				
Macrolides										
Erythromycin	EUCAST	4		4	0.12	16				
Penicillins										
Ampicillin	EUCAST	8		8	0.5	64				

Footnote

Applies to Campylobacter jejuni

Table Breakpoints used for antimicrobial susceptibility testing in Food

Test Method Used

- Disc diffusion
- Agar dilution
- Broth dilution
- E-test

Standards used for testing

Campylobacter	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Tetracyclines										
Tetracyclin										
Fluoroquinolones										
Ciprofloxacin										
Enrofloxacin										
Quinolones										
Nalidixic acid										
Aminoglycosides										
Gentamicin										
Macrolides										
Erythromycin										
Penicillins										
Ampicillin										

Table Breakpoints used for antimicrobial susceptibility testing in Feedingstuff

Test Method Used

- Disc diffusion
- Agar dilution
- Broth dilution
- E-test

Standards used for testing

Campylobacter	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Tetracyclines										
Tetracyclin										
Fluoroquinolones										
Ciprofloxacin										
Enrofloxacin										
Quinolones										
Nalidixic acid										
Aminoglycosides										
Gentamicin										
Macrolides										
Erythromycin										
Penicillins										
Ampicillin										

2.3. LISTERIOSIS

2.3.1. General evaluation of the national situation

A. Listeriosis general evaluation

History of the disease and/ or infection in the country

Between 25 and 67 cases are recorded annually, the majority of these are immuno-suppressed, pregnant women and elderly.
In animals, an increased number of cases was observed in the late 1990s which might be due to increased usage of big bale silage and/ or increased number of autopsies (as part of the TSE surveillance). Since then the number of reported cases vary around 35 per year.

National evaluation of the recent situation, the trends and sources of infection

After a peak in the number of reported human cases in 2000 the annual number has decreased and the situation is now more stable. During 2006, 42 cases were notified. There was no change in the number of reported infected pregnant women. During 2006 one woman with listeriosis had a miscarriage.
In animals the situation is stable.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

Food borne transmission is believed to be more important than transmission from animals.

2.3.2. Listeriosis in humans

A. Listeriosis in humans

Reporting system in place for the human cases

Surveillance is based on passive case finding.

Case definition

A case is defined as a person from whom L. monocytogenes has been isolated from a normally sterile site. Mother and child/ foetus is regarded as one case.

Diagnostic/ analytical methods used

Cultivation from blood and cerebral spinal fluid.

Notification system in place

Invasive Listeria infection is notifiable under the Communicable Disease Act (both from the laboratory and from the physician).

History of the disease and/ or infection in the country

Around 25-35 cases were previously reported on a yearly basis, most of them from vulnerable groups (immuno-suppressed persons, pregnant women and elderly). The number of cases increased during 2000 (n=46) and peaked in 2001 (n=67). Since then the number of cases have declined.

Results of the investigation

After the peak in number of cases in 2000 the annual number has decreased and during 2006, 42 cases were notified. There was no change in the number of reported infected pregnant women. During 2006 one woman had a miscarriage, occurring in week 27.

Relevance as zoonotic disease

Food borne transmission is believed to be more important than transmission from animals. Listeriosis has practically only been relevant in immuno-suppressed people, pregnant women and elderly.

2.3.3. Listeria in foodstuffs

A. Listeria spp. in food

Monitoring system

Sampling strategy

Sampling is performed by local authorities on a random basis. No official control progam exists. Sampling usually takes place at retail level but can also be at production units.
Sampling performed by industry is not reported to the authorities unless specifically asked for.

Frequency of the sampling

At the production plant

Other: According to in-house control at each production plant.

At retail

Other: According to the local authorities own decisions.

Definition of positive finding

At the production plant

A sample positive for L. monocytogenes

At retail

A sample positive for L. monocytogenes

Diagnostic/ analytical methods used

At the production plant

Bacteriological method: NMKL 136 : 2004 is probably what is mostly used. For quantitative analysis an in-house (SLV) method is used.

At retail

Other: For diagnosis, an in-house (SLV) method is used for the quantitative analysis and NMKL 136 for qualitative analysis.

Preventive measures in place

Most production plants are focusing on preventing environmental contamination of the plant.

Control program/ mechanisms

The control program/ strategies in place

There is no official surveillance of L. monocytogenes in food and surveillance is done through

various projects initiated by the National food administration (SLV), municipalities and other research institutions.

Measures in case of the positive findings

If Listeria is found in food that will not be further heat-treated the food is regarded as unfit for human consumption if 3 out of 5 samples or more are found positive or 1 or more contains ≥100 L. monocytogenes/ gram. At retail level, where usually only one sample is taken the food will be regarded as unfit for human consumption if ≥100 L. monocytogenes / gram is found. Food for young children and sensitive populations are regarded as unfit for consumption if L. monocytogenes is found, regardless of concentration.

Results of the investigation

For results reported in 2006 see the prevalence tables for food

National evaluation of the recent situation, the trends and sources of infection

The situation is stable. Vacuumpacked smoked or marinated fish continues to be the major problem.

Additional information

During 2001, the National Food Administration (SLV) and the local municipalities performed a project with the aim to investigate the prevalence of L. monocytogenes in different ready-to-eat-foods. Out of 3600 samples, 63 (1.7%) were positive. It was shown that fish products had the highest percentage (6.2%) of positive samples.

Table Listeria monocytogenes in other foods

	Source of information	Sampling unit	Sample weight	Units tested	Total units positive for L.monocytogenes	Listeria monocytogenes presence in x g	> detection limit but =< 100 cfu/ g	L. monocytogenes > 100 cfu/ g
Fish								
smoked	local authorities	single	1 gram	28	1	1		
Other processed food products and prepared dishes	local authorities	single	1 gram	197	1	1		
Meat from bovine animals and pig	local authorities	single	1 gram	159	15	15		
Vegetables	local authorities	single	1 gram	10	0	0		

2.3.4. Listeria in animals

A. Listeria spp. in animal - all animals

Monitoring system

Sampling strategy

There is no active surveillance system and detection of cases is based on clinical observations.

Frequency of the sampling

When there is a suspected case.

Case definition

A case may be defined with (1) positive histopathology combined with clinical signs, (2) positive bacteriology and histopathology or, (3) positive immunohistochemistry and histopathology. The animal is the epidemiological unit.

Diagnostic/ analytical methods used

The diagnostic methods used include histopathology, immunohistochemistry and bacteriology.

Measures in case of the positive findings or single cases

In a verified case of listeriosis, the SJV decides from case to case to investigate the herd and clarify the source of infection.

Notification system in place

Listeriosis is notifiable in all animal species.

Results of the investigation

In 2006, 33 sheep, 4 cattle and 1 goat tested positive for Listeria. Other animals that tested positive were 1 dog, 1 deer and 1 pigeon. The number of tested animals is unknown.

National evaluation of the recent situation, the trends and sources of infection

Before 1999, there were between 10 and 20 reported listeria infections in animals per year. However, the number of cases increased from 1999 and onward (33-51 per year). An explanation for this may be the increased use of big bale silage.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Listeria spp are present in the environment and also to a small degree in food-producing animals, a risk of contracting domestic listeriosis does exist. However, cases of listeriosis in animals and listeriosis in humans are often not epidemiologically linked.

Table Listeria in animals

	Source of information	Sampling unit	Units tested	Total units positive for Listeria spp.	L. monocytogenes	Listeria spp., unspecified
Cattle (bovine animals)	SJV	animal		4		
Sheep	SJV	animal		33		
Goats	SJV	animal		1		
Dogs						
pet animals	SJV	animal		1		
Deer	SJV	animal		1		
Birds (1)	SJV	animal		1		

(1) : pigeon

Footnote

Units tested unknown.

2.4. E. COLI INFECTIONS

2.4.1. General evaluation of the national situation

A. Verotoxigenic Escherichia coli infections general evaluation

History of the disease and/ or infection in the country

In 1996, VTEC O157 was isolated in Swedish cattle for the first time and human E. coli O157 infection was traced back to a cattle herd. The same year, VTEC O157 in cattle became notifiable. However, since 1999, VTEC O157 findings are only notifiable when associated with human EHEC.
Between 1997 and 2002 annual prevalence studies of VTEC among cattle at slaughter were codnucted. Results showed that the prevalence was around 1%. In the prevalence study 2005/ 06 the prevalence was 3.4%. These figures cannot be compared as the laboratory methodology had been slightly modified.
Between 1998 and 2003, the number of domestic human VTEC O157 infections varied from 59-97, apart from 2002 when 129 cases were reported. This was due to an outbreak of VTEC O 157 infection (including 28 cases) in southern Sweden (county of Skane), caused by contaminated locally produced fermented cold-smoked sausages.
In 2004, the Communicable Diseases Act was changed to include all serotypes of VTEC instead of only VTEC O157. This change has caused a great increase in reported cases to a total number of 182.
In 2005 there was an extraordinary peak in the number of EHEC cases (385 ill people in total). The peak was partly due to a large outbreak including 135 cases, caused by contaminated salad.

National evaluation of the recent situation, the trends and sources of infection

VTEC infection is a serious zoonotic infection and cattle, or products there of, are important sources of infection. The majority of human cases are reported from the western part of Sweden and in this region it seems to be a special cluster of VTEC O157, perhaps more pathogenic than others. Furthermore, most of the VTEC positive farms are located in the same area. Domestically produced food has been the source of infection at two larger outbreaks (see above). It cannot be excluded that outbreaks caused by domestic produced foods may occur in the future.
In 2005 there was an overall increase of human cases with EHEC. One explanation to this is the change in the legislation, to include all the serotypes. There was also a large outbreak.
In 2006 the number of cases was lower again, as no large outbreaks were reported.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

In case of human infection, trace back investigation is performed. If the infection is traced back to a farm with animals, special recommendations are given, for example about improved hygiene. The majority of human cases of sporadic EHEC O157 infection are reported from the area with the highest herd prevalence of VTEC O157, that is the western part of Sweden.

Recent actions taken to control the zoonoses

In 2006, a commission to perform a risk profile of VTEC in humans, food and animals was given to a number of national authorities by the Ministry of Africulture.

2.4.2. E. Coli Infections in humans

A. Verotoxigenic Escherichia coli infections in humans

Reporting system in place for the human cases

Surveillance is based on passive case findings.

Case definition

A case is defined as a person from whom EHEC (of any serotype) has been isolated.

Diagnostic/ analytical methods used

Cultivation and nucleic acid amplification.

Notification system in place

Since 1st of July 2004 all serotypes of EHEC is notifiable under the Communicable Disease Act (both from the laboratory and the physician). Before that types other than O157 were reported on a voluntary basis. Both clinical and subclinical cases are included. However, the Haemorrhagic Uremic Syndrome (HUS) is not notifiable.

History of the disease and/ or infection in the country

In late 1995 and early 1996, there was an outbreak of EHEC O157 (VTEC O157) including approximately 120 cases. The outbreak increased the awareness of EHEC O157 and after this event most people with haemorrhagic diarrhoea are investigated for EHEC O157.
Between 1998 and 2001, the number of human cases varied between 59 and 97.
In 2002, physicians reported 129 cases. This sudden increase in number of cases was caused by two outbreaks caused by water (n=11) and contaminated cold-smoked sausage (n=28), respectively.
In 2003 the number of cases were lower again (n=73).
During 2004 the Communicable Disease Act was changed to include all serotypes of EHEC (VTEC) instead of just EHEC O157. This change in the legislation, caused a great increase in reported cases to a total number of 182.
In 2005 there was an extraordinary peak in the number of EHEC cases (385 ill people in total). The peak was partly due to a large outbreak including 135 cases, which was caused by iceberg lettuce.

Results of the investigation

In 2006 265 EHEC cases were reported, of which 68% had acquired their infection in Sweden. The decrease in comparison to the peak in 2005 seems large, but if excluding the cases from the salad outbreak, the number of cases was approximately the same both years.
There were two smaller outbreaks observed during the year. One of these was caused by children having a picnic in a field together with sheep. EHEC O121 of the same strain was isolated from a girl as well as from the sheep.

National evaluation of the recent situation, the trends and sources of infection

As during earlier years most cases in 2006 were reported during the summer months in June to

August.
As usual children under the age of ten years were most affected by the disease. 32% more women than men were reported.
Most cases were reported from the Swedish west coast and from the county of Skåne.

Relevance as zoonotic disease

EHEC (VTEC) O157 is a serious zoonotic infection and it cannot be excluded that large outbreaks may occur in the future. Compared with other food borne infections, infection with EHEC O157 can be serious, especially in young children developing HUS. There is a lack of knowledge concerning the possibilities to determine if an efficient control strategy of VTEC O157 can be implemented in the primary production. For prophylactic reasons, it has been recommended that young children (<five years of age) should avoid visiting cattle farms and hygiene recommendations have been issued for other visitors. There is also a lack of epidemiological knowledge about serotypes other than O157 in animals, although it is known that these serotypes cause a significant part of the EHEC (VTEC) infections in humans. More research is needed to estimate the true occurrence of these serotypes in animals, food and humans as well as their zoonotic impact.

2.4.3. Escherichia coli, pathogenic in foodstuffs

2.4.4. Escherichia coli, pathogenic in animals

A. Verotoxigenic Escherichia coli in cattle (bovine animals)

Monitoring system

Sampling strategy

TRACE BACK OF HUMAN INFECTION:
If a County Medical Officer in a Swedish county suspects that a human VTEC infection has been acquired after animal contact, the County Veterinary Officer will be informed, and state a request to the Swedish Board of Agriculture for sampling animals on the relevant farm. Sampling is targeted mainly against young stock, as they are more prone to shed the bacteria, and performed by a veterinarian.
If a cattle herd has been linked to a human EHEC case and VTEC strains with identical subtyping pattern (PFGE) as the human isolate has been isolated from cattle, it is recommended that animals from this farm are sampled during slaughter. From those animals, carcase swabs are collected and the carcases are arrested awaiting the answer of this investigation.
PREVALENCE STUDIES:
Prevalence studies will be conducted in appraoximately every 3rd year. The last study was conducted 2005/ 06. In these surveys, around 2000 faecal samples are collected randomly throughout the year from cattle at the slaughterhouses for bacteriological investigation of VTEC O157. Samples are collected by veterinarians.

Frequency of the sampling

Animals at farm

Other: Trace back of human VTEC infection.

Animals at slaughter (herd based approach)

Other: study (animal based): sampling distributed evenly throughout the year

Type of specimen taken

Animals at farm

Other: Faeces and/ or milkfilter.

Animals at slaughter (herd based approach)

Other: study (animal based): faeces, ear samples; trace back: carcass swabs

Methods of sampling (description of sampling techniques)

Animals at farm

TRACE BACK OF HUMAN INFECTION: Up to 100 individual faecal samples per

farm are collected. Mainly young animals are sampled. Most samples are analysed as pooled samples with up to five individual samples pooled to one consisting of 25 g.
For individual faecal samples, approximately 30 g of faeces are collected.

Animals at slaughter (herd based approach)

TRACE BACK OF HUMAN INFECTION: Carcass swabs are collected from the inner part of the hind legs. A total of 30x20-25 cm or a total of approximately 700cm2 will be swabbed.
SINGLE STUDY (ANIMAL BASED APPROACH):
After slaughter 30 g of faeces were collected from the rectum with disposable plastic gloves and placed in plastic cups. Also, the outer 1/ 3 of the ear was removed after slaughter. Samples collected in the study were analysed individually.

Case definition

Animals at farm

A case is defined as an animal from which the investigated VTEC serotype is isolated. The herd is the epidemiological unit.

Animals at slaughter (herd based approach)

A positive herd is defined as a herd from which an animal tested positive for the VTEC serotype investigated for.
SINGLE STUDY:
A case was defined as an animal from which VTEC O157 was isolated.

Diagnostic/ analytical methods used

Animals at farm

Other: NMKL No 164:2005 2nd ed

Animals at slaughter (herd based approach)

Other: NMKL No 164:2005 2nd ed

Other preventive measures than vaccination in place

The guidelines established in 1997 were revised in 2004. They give recommendations of how to minimize spread of VTEC to other animals, neighbouring farms and to people (especially children). In 2004, binding directives were introduced by the SJV to prevent disease associated with animals in public settings. According to the directives, each setting should establish a written hygiene programme, inclusive of visitors instructions. A qualitative risk assessment was made as a guideline for the establishment of these compulsory preventive measures in which testing for VTEC of ruminants used for exhibition is recommended.

Control program/ mechanisms

Recent actions taken to control the zoonoses

In 2006, a risk profile for VTEC was made by the National Food Administration (SLV), Board of Agriculture (SJV), National Veterinary Institute (SVA), Institute of Infectious Disease Control (SMI), Board of Health and Welfare (SoS) and the Swedish Environmental Protection Agency (NV).

Suggestions to the Community for the actions to be taken

It could be discussed if it would be beneficial to harmonise monitoring of VTEC prevalence in cattle within the EU.

Measures in case of the positive findings or single cases

The guidelines include recommendations of how to handle VTEC in cattle when associations have been made with human VTEC infection. For example that animals should be tested negative for VTEC prior to transport and slaughter, and that hygiene recommendations should be instituted at the farm. Faecal samples are collected repeatedly in the epidemiological unit (usually the herd) from a representative numbers of animals of different age.

Notification system in place

VTEC O157 is notifiable in animals if there is an epidemiological link to human VTEC infection.

Results of the investigation

5 cattle farms were sampled for VTEC in trace back of human infection. From 2 farms, identical VTEC O157 strains were isolated as from the patients, and from one farm VTEC O121. From the latter farm, VTEC O121 was also isolated from sheep. From additional two sheep farms the same strains of VTEC O157 and O103 was isolated as from human cases.
The prevalence study conducted at slaughter 2005-06 was finalised in 2006. During 2006, 1205 faceal samples were analysed and of those 37 (3%) were positive. Furthermore, 294 ear samples were analysed and 32 (11%) were positive.
Results from the whole study period (2005/ 06)were as follows: 61/ 1773 (3.4%) faecal samples were positive and 55/ 451 (12%) ear samples.

National evaluation of the recent situation, the trends and sources of infection

VTEC infection is regarded as a serious zoonotic infection and cattle, or products thereof, are important sources of human infection. A large proportion of human VTEC O157 cases are reported from the western part of Sweden (county of Halland). It has also been shown that a large proportion of VTEC O157 positive farms are in the same area. It seems to be a special cluster of VTEC O157 in this region, perhaps more pathogenic than others.
It cannot be excluded that outbreaks caused by domestic produced foods will occur in the future.
Compared with previous studies the prevalence increased from around 1% to 3.4%. Reasons for this can be a slightly modified bacteriological culture method, or a true increased prevalence.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

Direct or indirect contact with cattle is an important source of human infection. Another important source is consumption of contaminated foods, for example un-pasteurised milk. Two outbreaks caused by domestic food has been recorded: 1) 28 cases were reported in 2002. The source of infection was

locally produced sausage. 2) In 2005 an outbreak including 135 cases was reported. The cource of infection was locally produced salad that had been irrigated by contaminated water from a nearby canal. Both outbreaks were reported from areas where VTEC O157 is prevalent in cattle farms.

Additional information

In 1996, VTEC O157 was isolated in Swedish cattle for the first time and human E. coli O157 infection was traced back to presence of VTEC O157 in a cattle herd. Restrictions were laid on the herd and surveillance was initiated. The same year, VTEC O157 in cattle became notifiable. However, since 1999, VTEC O157 findings are only notifiable when associated with human VTEC infection.
From 1996-2006, one to ten farms have been investigated annually as suspected sources of human infection. Of those, 1-4 farms per year have been confirmed as sources of infection (in total 38 herds). VTEC O157 have been detected on all farms but four (VTEC O8, O26, O121 and O103). One of the herd was a goat herd and two had sheep.
In 1998 a survey was conducted at slaughterhouse level in other animals but cattle. The results showed that 0.8 % (4/ 474) lambs and 0.9 % (1/ 109) sheep and 0.08% (2/ 2446) pigs were positive for VTEC O157.
Between 1996 and 2003, the industry (Swedish Meats) analysed 334-968 carcass swabs at the slaughterhouses. Sporadic positive samples were found during four years.
Another study has showed that 9% of the dairy herds in Sweden were positive for VTEC O157, of these, 23% were situated in the Western part of Sweden (the county of Halland).
Between 1997 and 2002, prevalence studies for VTEC O157 in cattle have been conduceted at slaughterhouse level. The results showed an overall individual prevelance of 0.3-1.7%. The highest prevalence (5.3%) was recorded in calves 7-9 months of age, followed by young stock 12-18 months of age (1.6%) and adult cattle (0.7%). As results did not change much throughout between the years additional prevalence studies will be performed approx every 3rd year. The last study was conducted 2005/ 06.

Table VT E. coli in animals

	Source of information	Sampling unit	Units tested	Total units positive for Escherichia coli, pathogenic	E.coli, pathogenic, unspecified	Verotoxigenic E. coli (VTEC)	Verotoxigenic E. coli (VTEC) - VTEC O157	Verotoxigenic E. coli (VTEC) - VTEC, unspecified	Verotoxigenic E. coli (VTEC) - VTEC O103	Verotoxigenic E. coli (VTEC) - VTEC O121
Cattle (bovine animals) (1)	SJV	herd	5	3		3	2			1
- at slaughterhouse - animal sample - faeces - Surveillance - surveillance survey - objective sampling (3)	SJV	animal	1205	37		37	37			
- at slaughterhouse - animal sample - Surveillance - surveillance survey - objective sampling (4)	SJV	animal	294	32		32	32			
Sheep (2)	SJV	herd	3	3		3	1		1	1
Solipeds, domestic	SJV	animal	1	0						

(1) : Trace back investigation of human VTEC infection. The O121 positive farm also had sheep positive for the same serotype.
(2) : Trace back investigation of human VTEC infection. The farm positive for O121 also had O121 positive cattle.
(3) : Faecal samples from the prevalence study 2006/ 07. 1205 out of 1773 samples were collected in 2006.
(4) : Ear samples from the revalence study 2006/ 07. 294 out of 451 ear samples were collected in 2006.

2.5. TUBERCULOSIS, MYCOBACTERIAL DISEASES

2.5.1. General evaluation of the national situation

A. Tuberculosis general evaluation

History of the disease and/ or infection in the country

M. bovis:
Sweden was declared free from bovine tuberculosis in 1958. Until 1978, sporadic cases occurred in cattle. Compulsory tuberculin testing of all cattle was abolished in 1970 and the national bovine TB control in cattle was based on meat inspection. When Sweden joined the European Community in 1995 the status of OTF (officially tuberculosis free) was obtained. No cases have been repored in wildlife for more than 55 years.
M. bovis was diagnosed in farmed deer in 1991. Trace back investigation revealed that the infection was introduced by imported deer in 1987. In 1994, a voluntary control programme was introduced that became mandatory in 2003. In total, 13 herds have tested positive and all have been depopulated.
In humans, less than 10 cases of M. bovis are notified annually in Sweden. Most of these are found in elderly people, infected in their youth before bovine TB was eradicated in Sweden, or in immigrants from areas where bovine TB is still common.
M. tuberculosis:
Between 2001 and 2005, M. tuberculosis was diagnosed in elephants and giraffes at a zoo in eastern part of Sweden, and in one elephant at a zoo in the western part. The animals were euthanised and a thorough investigation was performed (See "M. Tuberculosis in Zoo animals"). No human infection has been associated to this outbreak.

National evaluation of the recent situation, the trends and sources of infection

The national situation remains favourable.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

As Sweden is OTF, the risk of contracting domestic TB from livestock and other animals is negligible.
The risk for animal keepers to contract infection with M. tuberculosis from elephants is small, but cannot be ruled out as elephants, and other relevant animals at zoos, might carry subclinical infection.

2.5.2. Tuberculosis, Mycobacterial Diseases in humans

A. Tuberculosis due to Mycobacterium bovis in humans

Reporting system in place for the human cases

Surveillance is mainly based on passive case findings; however, it is recommended that refugees and asylum seekers are screened for TB.

Case definition

A case is defined as a person from whom M. bovis has been isolated

Diagnostic/ analytical methods used

The diagnostic methods used are cultivation and isolation of M. bovis in clinical specimen in addition to possible direct detection of nucleic acid. Further verification is however needed by means of different molecular genetic techniques.

Notification system in place

Tuberculosis is a notifiable disease under the Communicable Disease Act (both from the laboratory and from the physician).

Results of the investigation

Four cases of M. bovis infection were reported, of which 2 were older than 65 years old and born in Sweden. Most likely they became infected before Sweden was declared free from bovine TB. The remaining 2 persons were younger, immigrants and had probably acquired their infection abroad.

Relevance as zoonotic disease

Most cases of M. bovis infection in the Swedish population are acquired abroad. Apart from this, cases also occur among elderly people who got infected before M. bovis was eradicated from the Swedish cattle population. As Sweden is OTF, the risk of contracting domestic TB from animals is negligible. Also, the risk of contracting bovine TB from people in Sweden is considered extremely low as there are few cases of human TB caused by M. bovis in Sweden and person-to-person spread is rare.

2.5.3. Mycobacterium in animals

A. Mycobacterium bovis in bovine animals

Status as officially free of bovine tuberculosis during the reporting year

The entire country free

Sweden was declared free from bovine tuberculosis in 1958. When Sweden joined the EU in 1995, the status of Officially Tuberculosis Free (OTF) was obtained (former Decision 95/ 63/ EC, Commission Decision 03/ 046/ EG, as last amended by 04/ 230/ EG. Sweden fulfils the requirements for control measures in OTF member states (Council Directive 64/ 432/ EEC, Annex A, as last amended by 00/ 20/ EC).

Monitoring system

Sampling strategy

Monitoring is performed by meat inspections at slaughter of food producing animals. The inspection is performed by the SLV. If TB is suspected, samples are collected and analysed at the SVA. Furthermore, tuberculin tests are performed at artifical insemination stations and at export/ import of animals as required according to EU-legislation (Council Directive 64/ 432/ EEC). Sampling is also performed in case of clinical suspicion.

Frequency of the sampling

All cattle is inspected at slaughter and samples are taken in case suspected pathological changes are detected. Samples are also collected at necropsy in case of clinical suspicion or positive tuberculin test.

Type of specimen taken

Organs/ tissues: Samples from organs/ tissues with suspected lesions and adjacent lymph nodes. Both fresh and formalin fixed samples.

Methods of sampling (description of sampling techniques)

If TB is suspected after a positive tuberculine test, several lymph nodes are collected for histopathology, acid fast staining of direct smears and mycobacterial culture. Any organ with gross lesions is also sampled. Lymph nodes always collected for culture include retropharyngeal, submandibular, parotideal, medistinal, tracheobronchial, mesenterial, iliacal and inguinal lymph nodes. Lymphnodes are pooled for culture, wheras organs with pathological changes are cultured separately.

Case definition

A positive case is defined as an animal from which M. bovis. M. tuberculosis, or any other mycobacteria in the M. tuberculosis-complex has been isolated.

Diagnostic/ analytical methods used

Samples from autopsy/ meat inspection are investigated by histology and direct smears. If TB cannot be ruled out by these methods, culture is performed. For culture, lymph nodes are pooled (including at least two lymph nodes from each region) whereas organs with pathological lesions are cultured separately. Culture is performed
according to the method SVA 4120 and SVA 4122. Cultures are read once/ week for eight weeks and microscopy of suspected colonies is performed. If acid-fast rods are seen, a molecular probe for the M. tuberculosis complex is applied to colony material. If deemed necessary, re-culture is carried out at four weeks. In case mycobacteria in the M. tuberculosis-complex is isolated the strain is further subtyped.

Vaccination policy

Vaccination is not allowed.

Control program/ mechanisms

The control program/ strategies in place

Sweden is OTF and fulfils the requirements on control measures in OTF member states (see "The entire country free").

Suggestions to the Community for the actions to be taken

Apply rules for TB control on all domestic animal species and not just cattle.

Measures in case of the positive findings or single cases

If tuberculosis would be diagnosed in a food producing animal eradication measures are implemented, including depopulation of the whole herd, in accordance with the Swedish Act of Epizootics.

Notification system in place

Infection with M. bovis, M. tuberculosis, or other mycobacteria in the M. tuberculosis-compelx, is compulsory notifiable in all animal species on the basis of suspicion (for ex clinical- or post mortem suspicion).

Results of the investigation

In total, 9 cattle were investigated for M. bovis in 2006, all were negative. Of those, reasons for investigation was that TB could not be ruled out at slaughter inspection (n=7) and at autopsy (n=2). Culture was performed in one animal.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Sweden is OTF, the risk of contracting domestic TB from animals is negligible.

Additional information

Animals other than cattle:
Apart from the tested cattle mentioned above, other animals were also tested for bovine TB in 2006. For example, 19 pigs were investigated, following suspicion at meat inspection. After histological

invstigation and direct smears 5 were cultured. All were negative. Other animal species tested are shown in Table Tuberculosis in other animals.

B. Mycobacterium bovis in farmed deer

Monitoring system

Sampling strategy

In 1994, a voluntary official control programme was implemented. In June 2003, the control programme became compulsory. In the programme, tuberculin tests are performed regulary and any herd found positive for bovine TB is depopulated. Furthermore, all animals are inspected at slaughter. In the voluntary programme, all animals >1 year that are found dead or euthanised are subjected to autopsy, whereas this applies to animals of all ages in the mandatory programme.
Sampling is also performed in case of clinical suspicion.

Frequency of the sampling

Sampling is performed after any suspicion of TB, for example if TB is suspected after meat inspection of slaughtered animals, if there is a clinical suspicion, or if there is a positive tuberculin test.
SAMPLING IN THE CONROL PROGRAMME
In brief, a herd obtains Bovine TB-free status (A-status) after three consecutive whole herd tuberculin tests of all deer older than one year, with negative results. Only herds with A-status may sell live deer and to maintain the A-status all female deer have to be tested after two years and then every third year, without reactors. Bovine TB-free status can also be obtained by slaughter of the whole herd and repopulation with deer from TB-free herds (A-status).

Type of specimen taken

Organs/ tissues: Samples from organs/ tissues with suspected lesions and adjacent lymph nodes. Both fresh and formalin fixed samples.

Methods of sampling (description of sampling techniques)

If TB is suspected after a positive tuberculin test, several lymph nodes are collected for histopathology, acid fast staining of direct smears and mycobacterial culture. Any organ with gross lesions is also sampled. Lymph nodes always collected for culture include retropharyngeal, submandibular, parotideal, medistinal, tracheobronchial, mesenterial, iliacal and inguinal lymph nodes. Lymph nodes are pooled for culture, wheras organs with pathological changes are cultured separately.

Case definition

A positive case is defined as an animal from which M. bovis, M. tuberculosis, or other mycobacteria in the M. tuberculosis-complex, have been isolated.

Diagnostic/ analytical methods used

Samples from necropsy/ meat inspection are investigated by histology and direct smears. The result from these tests determines if culture is performed. Culture is performed according to the method SVA 4120 and SVA 4122. Cultures are read once/ week for eight weeks and microscopy of suspected colonies is performed. If acid-fast rods are seen, a molecular probe for the M. tuberculosis complex is used on colony materials. If deemed necessary, re-culture is carried out at four weeks. In case mycobacteria in the M. tuberculosis-complex is isolated the strain is further subtyped.

Vaccination policy

Vaccination is not allowed.

Control program/ mechanisms

The control program/ strategies in place

A voluntary official TB control programme in farmed deer, administered by the industry (the Swedish Animal Health Service; Svenska djurhalsovarden) partially financed by the authorities, was implemented in July 1994. In June 2003, when 96% of all herds were affiliated to the program, the control program was made compulsory, including all herds in the country. At present, the programme is near finalisation.

Recent actions taken to control the zoonoses

The control programme has changed so that herds having tested negative four times do not need to continue testing. However, it is required to identify all animals >1 year of age with ear tags and inspect all slaughtered, euthanised or dead deer for TB.

Measures in case of the positive findings or single cases

If tuberculosis would be diagnosed in farmed deer eradication measures are implemented, including depopulation of the whole herd, in accordance with the Swedish Act of Epizootics.

Notification system in place

Infection with M. bovis, M. tuberculosis, or other mycobacteria in the M. tuberculosis-complex, is notifiable in all animal species on the basis of suspicion (for ex clinical- or post mortem suspicion).

Results of the investigation

All 635 deer herds in Sweden were affiliated in 2006. Since the beginning of the programme, 570 (90%) herds have been declared free from TB; 108 after three whole herd tuberculin tests, 372 after culling of the whole herd and subsequent meat inspection, and 90 herds were established with deer originating from TB free herds. Thus, 65 herds in the control programme are not yet declared free from TB. Compared with the previous year, 33 additional herds were declared free during 2006.
In the control programme, tuberculin tests were performed on 259 animals from 9 herds. One herd was tested twice.
16 deer were investigated by histology and direct smears after suspicion at meat inspection. All samples were negative.

National evaluation of the recent situation, the trends and sources of infection

As the control programme has run sucessfully throughout the years, and there only were a few farms not affiliated, the SJV made one of the final steps by making the programme mandatory. Thus, Sweden is about to start planning the end of the programme.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

It can be considered that the risk of contracting human TB from a farmed deer is negligble.

Additional information

The voluntary control programme became compulsory in 2003. Since the program's inception it has become evident that, on certain large extensive deer farms, it is difficult to muster all animals in the herd and virtually impossible to establish that no deer are present outside the mustering pen. An alternative control was needed in these herds. Followingly, the national legislation was amended so that owners of farms larger than 100 hectares and where there are no imported deer in the herd or any epidemiological links to imports, may apply to SBA for the alternative control for BTB, based on slaughter and meat inspection. In these herds, at least 20% of the herd (equally distributed over sex and age classes) shall be slaughtered annually for at least 15 years and the carcasses submitted for meat inspection. Furthermore, all other deer that are killed or die due to other reasons shall be meat inspected/ autopsied.

C. M. tuberculosis in animal - Zoo animals

Monitoring system

Sampling strategy

Sampling is performed in case of clinical suspicion, or if suspected lesions are detected at autopsy.

Type of specimen taken

Organs/ tissues: Samples from organs/ tissues with suspected lesions and adjacent lymph nodes. Both fresh and formalin fixed samples. Also tracheal and trunk samples may be taken.

Methods of sampling (description of sampling techniques)

If TB is suspected after a positive tuberculine test, several lymph nodes are collected for histopathology, acid fast staining of direct smears and mycobacterial culture. Any organ with gross lesions is also sampled. Lymph nodes always collected for culture include retropharyngeal, submandibular, parotideal, medistinal, tracheobronchial, mesenterial, iliacal and inguinal lymph nodes. Lymph nodes are pooled for culture, wheras organs with pathological changes are cultured separately.
In some cases of low suspicion, where killing of the animal is not immediately necessary, trachal or trunk (for elephants) samples are taken.

Case definition

A positive case is defined as an animal from which M. bovis, M. tuberculosis, or other

mycobacteria in the TB-complex has been isolated.

Diagnostic/ analytical methods used

Samples collected at necropsy are investigated by histology and direct smears. The result from these test determines if culture is done. Apart from this, samples from animals that were positive in the tuberculin test are always cultured. Culture is performed according to the method SVA 4120. Cultures are read once/ week for eight weeks and microscopy of suspected colonies is performed. If deemed necessary, re-culture is carried out at four weeks. If growth of acid-fast rods is seen, a molecular probe for the M. tuberculosis complex is used on colony material. In case mycobacteria in the M. tuberculosis-complex are isolated the strain is further subtyped.

Vaccination policy

Vaccination is not allowed.

Other preventive measures than vaccination in place

Presently, trunk- or trachael lavage for detection of mycobacteria in the M. tuberculosis-complex in elephants, and other relevant zoo-animals, are performed at the two largest Zoos in Sweden, where TB has been diagnosed on a few occasions since 2001.

Control program/ mechanisms

The control program/ strategies in place

There is no specific control programme for Zoo animals.

Suggestions to the Community for the actions to be taken

One suggestion is to make findings of mycobacteria in the M. tuberculosis-complex compulsory notifiable.

Measures in case of the positive findings or single cases

If tuberculosis would be diagnosed in a Zoo animal eradication measures are implemented, in accordance with the Swedish Act of Epizootics.

Notification system in place

Findings of M. bovis, M. tuberculosis, or other mycobacteria in the TB-complex is notifiable in all animal species on the basis of clinical suspicion.

Results of the investigation

In 2006, one out of two tested giraffes was positive for M. tuberculosis. The giraffe was from a zoo in the Eastern part of Sweden. A few other exotic animals were tested at this zoo, those are presented in the table "Tuberculosis in other animals".

National evaluation of the recent situation, the trends and sources of infection

Zoo animals, especially elephants, have been shown to present a risk for transmitting tuberculosis and this merits further attention.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

The Zoo animals that were positive for M. tuberculosis have most likely carried the infection subclinically for long periods. It cannot be ruled out that there is a risk for animal care takers to contract TB from these animals. However, repeated follow up testing of exposed personnel at the Zoo that was put under restriction between 2001 and 2003 have not revealed any TB infection.
The risk for Zoo visitors to become infected is regarded as very small due to the sporadic contact with the animals.

Additional information

In 2001, M. tuberculosis was isolated from a diseased riding elephant at a zoo in the eastern part of Sweden. The zoo was immediately put under official restrictions and tuberculin testing and/ or bacteriological sampling was initiated in all contact animals and animal keepers. In total 5 elephants, including the index case, and one giraffe were euthanised due to positive culture. In 2003, the restrictions were lifted after cleaning and disinfection of all buildings and other housing of the infected animals. No human infection has been identified associated to these animal cases.
In Dec 2004, a female elephant at a Zoo in the western part of Sweden was positive for M. Tuberculosis. An epidemiological link was foudn between the two Zoos, and subtyping of the bacterial isoaltes confirmed this link.
In 2005, one giraff from a Zoo at the eastern part of Sweden was culture positive for M. Tuberculosis.

Table Tuberculosis in other animals

	Source of information	Sampling unit	Units tested	Total units positive for Mycobacterium spp.	M. bovis	M. tuberculosis	Mycobacterium spp., unspecified
Sheep	SVA, SJV	animal	3	0			
Pigs	SVA, SJV	animal	19	0			
Zoo animals, all (1)	SVA, SJV	animal	1	0			
Cattle (bovine animals) (2)	SVA, SJV	animal	9	0			
Solipeds, domestic							
horses	SVA, SJV	animal	1	0			
Dogs (3)	SVA, SJV	animal	7	0			
Cats	SVA, SJV	animal	4	0			
Mouflons	SVA, SJV	animal	2	0			
Alpacas							
zoo animals	SVA, SJV	animal	1	0			
Antelopes							
zoo animal (4)	SVA, SJV	animal	1	0			
Marine mammals							
zoo animals (5)	SVA, SJV	animal	1	0			
Giraffes							
zoo animal (6)	SVA, SJV	animal	2	1		1	
Deer							
farmed (7)	SVA, SJV	animal	16	0			

(1) : penguin
(2) : culture n=1
(3) : culture n=3
(4) : culture n=1
(5) : culture n=1, dolphin
(6) : The positive individual was preliminary identifed in 2005, but cultured in 2006
(7) : culture n=1

Table Bovine tuberculosis in countries and regions that do not receive Community co-financing for eradication programmes

Region	Total number of existing bovine		Officially free herds		Infected herds		Routine tuberculin testing		Number of tuberculin tests carried out before the introduction into the herds (Annex A(I)(2)(c) third indent (1) of Directive 64/ 432/ EEC)	Number of animals with suspicious lesions of tuberculosis examined and submitted to histopathological and bacteriological examinations	Number of animals detected positive in bacteriological examination
	Herds	Animals	Number of herds	%	Number of herds	%	Interval between routine tuberculin tests (*)	Number of animals tested			
SVERIGE	26179	1604933	26179	100	0	0				1	0
Total	26179	1604933	26179	100	0	0		0	0	1	0

Footnote

Note that numbers of herds and animals are from 2005.
Additional 8 cattle were subjected only to histopathology investigation, all were negative.

(*) Legend:

In column "Interval between routine tuberculin tests" use the following numeric codes: (0) no routine tests; (1) tests once a year; (2) tests each two years; (3) tests each three years concerning 24 month-old animals; (4) tests each 4 years; (5) others (please give details).

Table Tuberculosis in farmed deer

Region	Total number of existing farmed deer		Free herds		Infected herds		Routine tuberculin testing		Number of tuberculin tests carried out before the introduction into the herds	Number of animals with suspicious lesions of tuberculosis examined and submitted to histopathological and bacteriological examinations	Number of animals detected positive in bacteriological examination
	Herds	Animals	Number of herds	%	Number of herds	%	Interval between routine tuberculin tests (*)	Number of animals tested			
SVERIGE	635	22361	570	89.764	0	0				1	0
Total	635	22361	570	89.764	0	0		0	0	1	0

Footnote

*570 herds are free, the remaining 65 are not classified as infected. If a herd would be infected, all animals are euthanised. *Tuberculin testing: There is a stepwise procedure for a herd to be declared free. For detailed information, see text "Mycobacterium bovis in farmed deer" *Additional 15 animals were subjected only to histopathological examination.

(*) Legend:

In column "Interval between routine tuberculin tests" use the following numeric codes: (0) no routine tests; (1) tests once a year; (2) tests each two years; (3) tests each three years concerning 24 month-old animals; (4) tests each 4 years; (5) others (please give details).

2.6. BRUCELLOSIS

2.6.1. General evaluation of the national situation

A. Brucellosis general evaluation

History of the disease and/ or infection in the country

The last case of bovine brucellosis in Sweden was reported in 1957. Brucellosis has not been diagnosed in other animal species. Sweden was declared officially brucellosis free (OBF) in cattle 1995 and in goats and sheep (OBmF) 1994, and fulfils the requirements on control measures in OBF and OBmF member states.
The few yearly cases in humans are all suspected to have been acquired abroad.

National evaluation of the recent situation, the trends and sources of infection

The national situation remains stable. This is shown in the yearly serological surveillance in cattle, pigs, sheep and goats. Since the start of the surveillance (mid 1990s), no positive sample has been detected.
Each year there are usually a few clinical suspicions of brucella infection in animals, for example abortions or genital infections, all of which have been negative in serological/ bacteriological analyses.
The sitution in humans remains stable.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

The risk of obtaining brucellosis from domestic sources is negligible, as Sweden is declared OBF and ObmF.

2.6.2. Brucellosis in humans

A. Brucellosis in humans

Reporting system in place for the human cases

Surveillance is based on passive case finding.

Case definition

A case is defined as a person in whom brucellosis has been verified serologically or bacteriologically.

Diagnostic/ analytical methods used

Cultivation from blood and bonemarrow.

Notification system in place

Since 1st of July 2004 brucellosis is a notifiable disease under the Communicable Disease Act (both from the laboratory and from the physician).

History of the disease and/ or infection in the country

From the 1st of July 2004 brucellosis is a notifiable disease and before that the figures were based on voluntary laboratory reports.
During the last 10 years, up to eleven cases have been reported annually. None of these were suspected to be of domestic origin.

Results of the investigation

Four cases were reported in 2006, all infected abroad.

National evaluation of the recent situation, the trends and sources of infection

The few yearly cases in humans are all suspected to have been acquired abroad.

Relevance as zoonotic disease

The risk of obtaining brucellosis from domestic sources is negligible, as Sweden is declared free from bovine, caprine and ovine brucellosis. Furthermore, brucellosis has not been recorded in animal species in Sweden.

2.6.3. Brucella in foodstuffs

2.6.4. Brucella in animals

A. Brucella abortus in bovine animals

Status as officially free of bovine brucellosis during the reporting year

The entire country free

Sweden is declared officially brucellosis free (OBF) in cattle since 1994, Decision 2003/ 467/ EC last amended by Decicion 2005/ 764/ EC (originally in Act of Accession of Austria, Finland and Sweden and in former Decisions 94/ 972/ EC and 94/ 74/ EC). Current surveillance standards for bovine brucellosis are given in the EU legislation, Directive 64/ 432/ EEC.

Monitoring system

Sampling strategy

All clinically suspected cases have to be confirmed serologically and bacteriologically. Cattle are investigated serologically at breeding stations and before import or export. On a national initiative, serological surveys are regularly performed in cattle, in bulk milk and/ or individal serum samples. The industry (Swedish Dairy Association) collect serum and bulk milk samples in their various control programmes. Of those samples, 1000 serum and 2000 bulk milk samples, respectivly, are systematically collected for serological screening of Brucella abortus.

Frequency of the sampling

The serological screening is performed anually. Individual animals are sampled at breeding stations and at import/ export. Herds are also sampled when there is a suspicion of brucellosis.

Type of specimen taken

Other: serum and/ or milk

Methods of sampling (description of sampling techniques)

Milk samples and sera are collected from dairy herds. The milk samples are pooled (5-50 individuals) before analysis. From beef herds, sera is only collected from cattle >2 years old. At least 0.5 ml sera is analysed.

Case definition

A positive case is defined as an animal from which Brucella spp. has been isolated, or an animal giving a significant antibody titre.

Diagnostic/ analytical methods used

The diagnostic test used is an indirect ELISA. For confirmation the complement fixation test and sometimes other tests, such as the tube agglutination test pr the Rose Bengal test, are used.

Vaccination policy

Vaccination is not permitted.

Measures in case of the positive findings or single cases

If brucellosis was diagnosed eradication and control measures would be implemented in accordance with the Swedish Act of Epizootics.

Notification system in place

Infection with Brucella spp. is notifiable in all animal species on the basis of clinical suspicion.

Results of the investigation

In the screening programme, serum samples from 1 000 cattle and bulk milk samples from 2000 dairy herds were analysed by use of an indirect ELISA. All samples were negative.
Additionally, 778 breeding animals, or animals for export, were tested and all were negative.
In three abortions of calves brucellosis could not be ruled out and culture were performed. However, none was positive.

National evaluation of the recent situation, the trends and sources of infection

The last case of bovine brucellosis was reported in 1957. Brucellosis has not been diagnosed in other animal species.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Sweden has been free from bovine brucellosis for many decades, the risk of contracting domestic brucella infection from cattle is considered negligible.

Additional information

Brucella abortus has been regularly tested for in cattle since 1988. From 1997 and forward, about 3 000 samples (bulk milk and/ or serum samples) have been tested yearly. Out of all these samples, none have been confirmed positive.
Several other animal species were tested before, mainly breeding or at import/ export (see table "Brucellosis in other animals").

B. Brucella melitensis in sheep

Status as officially free of ovine brucellosis during the reporting year

The entire country free

Sweden is declared officially brucellosis free and in goats and sheep (OBmF) since 1994 (Decision 94/ 972/ EC). The current surveillance standards are given in EU legislation, Directive 91/ 68/ EEC.

Monitoring system

Sampling strategy

In sheep and goats, surveillance is based on serological surveys according to EU-legislation. The samples from the sheep are collected within the voluntary control programme for Maedi-Visna. The number of samples each year represent approximately 5% of the sheep population.
In addition to this, all clinically suspected cases have to be examined serologically and bacteriologically. Samples are also collected at import/ export.

Frequency of the sampling

Annual testing of a sample of sheep. Herds are also sampled when there is a suspicion of brucellosis. Test are performed at import/ export.

Type of specimen taken

Blood

Case definition

A positive case is defined as an animal from which Brucella spp. has been isolated, or an animal giving a significant antibody titre. The herd is the epidemiological unit

Diagnostic/ analytical methods used

A buffered antigen test (Rose Bengal) was used and confirmation was done by a complement fixation test.

Vaccination policy

Vaccination is not permitted.

Measures in case of the positive findings or single cases

If brucellosis was diagnosed eradication measures would be implemented in accordance with the Swedish Act of Epizootics.

Notification system in place

Infection with Brucella spp. is notifiable in all animal species on the basis of clinical suspicion.

Results of the investigation

In total, 9597 individual serum samples from sheep were analysed and all were negative.
27 animals for import/ export tested negative.

National evaluation of the recent situation, the trends and sources of infection

Brucellosis has never been diagnosed in other animals than bovines (last case in 1957).

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Sweden has been free from ovine brucellosis for many decades, the risk of contracting domestic brucella infection from sheep is considered negligible.

Additional information

Brucella melitensis has been screened for in 5% (approximately 10.000 animals/ year) of the sheep population, and in a number of goats, yearly since 1995. Out of all these samples, none have been confirmed positive.

C. Brucella melitensis in goats

Status as officially free of caprine brucellosis during the reporting year

The entire country free

Sweden is declared officially brucellosis free in goats and sheep (OBmF) since 1994 (94/ 972/ EC). Current surveillance standards are given in EU legislation, Directive 91/ 68/ EEC.

Monitoring system

Sampling strategy

In sheep and goats, surveillance is based on serological surveys according to EU-legislation. The samples from goats were collected within the CAE programme. Furthermore, all clinically suspected cases have to be examined serologically and bacteriologically.

Frequency of the sampling

Annual testing of a sample for screening. Herds are also sampled when there is a suspicion of brucellosis.

Type of specimen taken

Blood

Case definition

A positive case is defined as an animal from which Brucella spp. has been isolated, or an animal giving a significant antibody titre.

Diagnostic/ analytical methods used

The buffered antigen test (Rose Bengal) was used and for confirmation a complement fixation test.

Vaccination policy

Vaccination is not permitted.

Measures in case of the positive findings or single cases

If brucellosis was diagnosed eradication measures would be implemented in accordance with the

Swedish Act of Epizootics.

Notification system in place

Infection with Brucella spp. is notifiable in all animal species on the basis of clinical suspicion.

Results of the investigation

In total, 427 individual sera from goats were analysed for antibodies against B. melitensis. All were negative.
Additional 9 goats tested negative at breeding or at export/ import.

National evaluation of the recent situation, the trends and sources of infection

Brucellosis has never been diagnosed in other animals than bovines (last case in 1957).

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Sweden has been free from caprine brucellosis for many decades, the risk of contracting domestic brucella infection from goats is considered negligible.

Additional information

Brucella melitensis has been screened for in 5% (approximately 10.000 animals/ year) of the sheep population, and in a number of goats, yearly since 1995. Out of all these samples, none have been confirmed positive. The herd is considered the epidemiological unit.

D. Brucella spp. in animal - Pigs

Monitoring system

Sampling strategy

The declaration of freedom from brucellosis in Swedish pigs is based on annual testing of a random sample of the pig population. The samples are collected within the yearly screening of Aujeszky´s disease.

Frequency of the sampling

Annual testing in the serological screening. Animals are also tested at breeding stations and at import/ export. Herds are sampled if there is a suspicion of brucellosis.

Type of specimen taken

Blood

Methods of sampling (description of sampling techniques)

The samples size is at least 0.5 ml sera.

Case definition

A positive case is defined as an animal from which Brucella spp. has been isolated, or an animal giving a significant antibody titre. The herd is the epidemiological unit.

Diagnostic/ analytical methods used

The Rose Bengal plate test (RBT) or complement fixation test is used.

Vaccination policy

Vaccination is not permitted.

Measures in case of the positive findings or single cases

If brucellosis was diagnosed eradication measures would be implemented in accordance with the Swedish Act of Epizootics.

Notification system in place

Infection with Brucella spp. is notifiable in all animal species on the basis of clinical suspicion.

Results of the investigation

In total, 3000 individual serum samples from pigs were analysed for antibodies against Brucella suis. All samples were negative. Additional 231 sera from wild boars were screened and all were negative. Apart from this, 1801 breeding animals or animals aimed for export/ import tested negative.

National evaluation of the recent situation, the trends and sources of infection

Brucellosis has never been diagnosed in other animals than bovines (last case in 1957).
Since 1995, Brucella has been screened for in approximately 3000 samples from pigs every year. Out of all these samples, none have been confirmed positive.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

As Sweden has been free from porcine brucellosis for many decades, the risk of contracting domestic brucella infection from pigs is considered negligible.

Additional information

Table Brucellosis in other animals

	Source of information	Sampling unit	Units tested	Total units positive for Brucella spp.	B. melitensis	B. abortus	B. suis	Brucella spp., unspecified
Pigs (1)	SVA	animal	1801	0				
- at farm - animal sample - blood - Surveillance - official controls (other than control and eradication programmes) - official sampling - objective sampling	SVA	animal	3000	0				
Wild boars (2)	SVA	animal	231	0				
Dogs								
pet animals (3)	SVA	animal	135	0				
Solipeds, domestic								
horses	SVA	animal	1	0				
Camels (4)	SVA	animal	19	0				
Reindeers (5)	SVA	animal	112	0				
Moose (6)	SVA	animal	8	0				
Deer (7)	SVA	animal	41	0				
Antelopes (8)	SVA	animal	5	0				
Alpacas (9)	SVA	animal	8	0				
Lamas (10)	SVA	animal	4	0				
Cattle (bovine animals) (11)	SVA	animal	778	0				
Goats (12)	SVA	animal	11	0				
Sheep (13)	SVA	animal	27	0				
Capricorns (14)	SVA	animal	6	0				
Other ruminants	SVA	animal	1	0				

(1) : breeding animals and animals for export
(2) : screening
(3) : breeding, import/ export and clinical suspicions
(4) : export/ import
(5) : export
(6) : export
(7) : export/ import (21 fallow deer and 20 red deer)
(8) : export/ import
(9) : export/ import
(10) : export/ import
(11) : breeding animals, animals for export/ import
(12) : export/ import
(13) : export/ import
(14) : export/ import

Table Bovine brucellosis in countries and regions that do not receive Community co-financing for eradication programme

Region	Total number of existing bovine		Officially free herds		Infected herds		Surveillance						Investigations of suspect cases								
							Serological tests			Examination of bulk milk samples			Information about abortions			Epidemiological investigation					
	Herds	Animals	Number of herds	%	Number of herds	%	Number of bovine herds tested	Number of animals tested	Number of infected herds tested	Number of bovine herds tested	Number of animals or pools tested	Number of infected herds	Number of notified abortions whatever cause	Number of isolations of Brucella infection	Number of abortions due to Brucella abortus	Number of animals tested with serological blood tests	Number of suspended herds	Number of positive animals		Number of animals examined microbio logically	Number of animals positive microbio logically
																		Serologically	BST		
SVERIGE	26179	1604933	26179	100	0	0	0	1000		2000	0	0		0	0	0	0	0	0	0	0
Total	26179	1604933	26179	100	0	0	0	1000	0	2000	0	0	0	0	0	0	0	0	0	0	0

Footnote

Note that figures for number of herds and animals are from 2005.
Breeding animals and animals tested at import/ export are not presented here as they were not sampled as "investigation of suspected cases".

Ovine or Caprine Brucellosis in countries and regions that do not receive Community co-financing for eradication programme

Region	Total number of existing ovine / caprine		Officially free herds		Infected herds		Surveillance			Investigations of suspect cases				
	Herds	Animals	Number of herds	%	Number of herds	%	Number of herds tested	Number of animals tested	Number of infected herds	Number of animals tested with serological blood tests	Number of animals positive serologically	Number of animals examined microbio logically	Number of animals positive microbio logically	Number of suspended herds
SVERIGE	7653	476793	7653	100	0	0	0	10024		0	0	0	0	0
Total	7653	476793	7653	100	0	0	0	10024	0	0	0	0	0	0

Footnote

Note that number of animals and number of herds are from 2005 and include only sheep.
Breeding animals and animals tested at import/ export are not presented here as they were not sampled as "investigation of suspected cases".

2.7. YERSINIOSIS

2.7.1. General evaluation of the national situation

A. Yersinia enterocolitica general evaluation

History of the disease and/ or infection in the country

Yersinia infection is not notifiable in animals, therefore there is little epidemiological data on the occurrence of the disease in animals.
In the beginning of the 1990s there were about 1000 annual human cases. Since then, there has been a decrease in the number of cases, which might be attributed to improved hygiene at slaughter and/ or decreased sampling in patients. During the last five years, around 550-800 cases per year have been reported.

National evaluation of the recent situation, the trends and sources of infection

Approximately 70% of human yersinia infections are of domestic origin. Of these, children below the age of six years predominate.
In 2005, for the first time in many years, less cases were reported than during the year before. In 2006 the trend was still pointing downwards.
The majority of the cases were as usual in the age group under ten years and a small majority was men.
In general, it is expected that meat from pigs are a common source of infection in humans.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

As pigs are common asymptomatic carriers of Yersinia it can be expected that meat from pigs is one of the sources of human infection.

Recent actions taken to control the zoonoses

2.7.2. Yersiniosis in humans

A. Yersinosis in humans

Reporting system in place for the human cases

Surveillance is based on passive case findings.

Case definition

A case is defined as a person from whom pathogenic Yersinia spp. has been isolated.

Diagnostic/ analytical methods used

Cultivation, serotyping and serology (antibody detection).

Notification system in place

Yersiniosis is a notifiable disease under the Communicable Disease Act since 1996 (both from the laboratory and from the physician).

History of the disease and/ or infection in the country

Prior to 1996, yersiniosis was only reported from laboratories. In the beginning of the 1990's, more than 1000 cases were reported. Until the turn of the century there was a steady decrease that probably was due to improved hygienic technique during slaughter of swine and/ or less sampling for Yersinia spp. in patients. However, from 2002 there was an increase in the number of cases. In 2005 the trend was pointing downwards again and this decrease continued in 2006.

Results of the investigation

During 2006 the trend of yersiniosis cases was pointing downwards for the second year in a row. This was true for both domestically acquired cases and for those infected abroad.
Most of the cases were reported during the summer months, May to August.
The majority of the cases were as usual in the age group under ten years and a small majority was men.

National evaluation of the recent situation, the trends and sources of infection

According to the reports from the physicians, two thirds of the cases suspected food or water being the source of infection.

Relevance as zoonotic disease

A significant part (approximately 70 %) of the human infections are of domestic origin. Yersinosis has its greatest potential as a zoonosis in young children. Reasons for this need to be further investigated. To be able to lower the number of cases, more detailed epidemiological knowledge is needed.

Additional information

In 2004, a yersinosis case-control study among children below six years of age was performed. Results will be presented.

2.7.3. Yersinia in foodstuffs

A. Yersinia spp. in food

Monitoring system

Sampling strategy

There is no official surveillance system for Yersinia spp. in food. From time to time, municipalities, the SLV and other research institutions initiate projects concerning the baseline prevalence.

Diagnostic/ analytical methods used

For diagnosis, bacteriological examination according to NMKL 117, 3rd ed, 1996 is used. In addition to this, a PCR, NMKL 163:1998, may also be used.

Measures in case of the positive findings or single cases

When products that will not be further heat treatment are positive for pathogenic serotypes of Y. enterocolitica, they will be classified as non-fit for human consumption and destroyed.

Results of the investigation

In 2006 the local authorities reported altogether 34 samples of various foods analysed for Yersinia in various categories of foods. No sample was positive for Yersinia.

Relevance of the findings in foodstuffs to human cases (as a source of human infection)

Fresh pig meat as well as pig meat products are considered to be the main source of Yersinia infection in humans.

Additional information

In 2004 the SLV performed a survey to investigate the presence of Yersinia in food. Out of 933 samples collected from fresh pig meat at retail 97 (10%) were positve, and 31 (6%) out of 522 samples from pig meat products at retail, were positive for Y. enterocolitica when analysed with PCR. Only one of the samples was positive after conventional culturing.

2.7.4. Yersinia in animals

A. Yersinia enterocolitica in pigs

Control program/ mechanisms

The control program/ strategies in place

There is no surveillance of Yersinia spp. in animals.

Notification system in place

Findings of Yersinia are not notifiable in animals.

2.8. TRICHINELLOSIS

2.8.1. General evaluation of the national situation

A. Trichinellosis general evaluation

History of the disease and/ or infection in the country

In domestic pigs, trichinosis has not been reported since 1994. Sporadic cases have been reported in free living or farmed wild boars and other wild life.
The last outbreak with human cases occurred in 1969.
Since the beginning of the 1990´s just two sporadic cases have been reported, one in 1997 and one in 2004. The last case had consumed cold smoked pork abroad.
The Directive 2075/ 2005 was not implemented in Sweden during 2006.

National evaluation of the recent situation, the trends and sources of infection

Trichinosis in farmed animals is, and has been, extremely rare for many years. The prevalence of Trichinella spp in wildlife that might be eaten (wild boars) is low to very low, while it is higher in carnivorous wildlife such as foxes, lynxes, wolves and bears.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

The risk of obtaining domestic trichinosis is negligible as all slaughtered pigs and horses are subject to meat inspection. However, for meat originating from wildlife, that might be infected with Trichinella, risk mitigation measures other than meat inspection, such as freezing, are necessary.

2.8.2. Trichinellosis in humans

A. Trichinellosis in humans

Reporting system in place for the human cases

Surveillance is based on passive case finding.

Notification system in place

Trichinellosis is a notifiable disease under the Communicable Disease Act (both from the laboratory and from the physician).

Description of the positive cases detected during the reporting year

No positive cases reported.

2.8.3. Trichinella in animals

A. Trichinella in pigs

Number of officially recognised Trichinella-free holdings

Sweden has not implemented a system of trichinella free holdings during 2006.

Monitoring system

Sampling strategy

General

Sweden did not implement a system of trichinella free holdings, or regions with negligble Trichinella risk, during 2006.
All domestic pigs are controlled for Trichinella at slaughter according to Council Directive 64/ 433/ EEC.

Frequency of the sampling

General

Every slaughtered pig is sampled.

Type of specimen taken

General

Diaphragm muscle

Methods of sampling (description of sampling techniques)

General

Methods used are in accordance to Council Directive 77/ 96/ EEC.
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Case definition

General

A case is defined as an animal in which Trichinella spp. is found. The epidemiological unit is the individual animal.

Diagnostic/ analytical methods used

General

Artificial digestion method of collective samples.

Measures in case of the positive findings or single cases

If an animal is found infected with Trichinella, the carcass will be destroyed. The competent authority will also investigate the source and possible spread of infection.

Notification system in place

Thrichinosis is compulsory notifiable in animals.

Results of the investigation including description of the positive cases and the verification of the Trichinella species

All slaughtered pigs (domestic pigs and wild boars) were negative for Trichinella spp.

National evaluation of the recent situation, the trends and sources of infection

Trichinosis in Swedish farmed pigs is extremely rare. The last case was found in 1994 and the situation remains favourable. Trichinella is sporadically found in wild and farmed wild boars.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

The risk of obtaining domestic trichinosis from farmed pigs is negligble.

Additional information

In 2006, 2/ 202 foxes, 3/ 70 lynx and 2/ 9 wolves were positive for trichinella. All investigated bears were negative.

B. Trichinella in horses

Monitoring system

Sampling strategy

All horses are controlled for Trichinella at slaughter according to Regulation 2075/ 2005/ EU (new regulation).

Frequency of the sampling

Every slaughtered horse (soliped) is sampled.

Type of specimen taken

Samples for musculus masseter or the tongue is analysed.

Methods of sampling (description of sampling techniques)

Methods used are in accordance to Council Directive 77/ 96/ EEC.

Case definition

A case is defined as a horse (soliped) in which Trichinella spp. is found and the epidemiological unit is the individual horse.

Diagnostic/ analytical methods used

Artificial digestion method of collective samples.

Results of the investigation including the origin of the positive animals

All slaughtered horses were negative for Trichinella spp.

Measures in case of the positive findings or single cases

If an animal is found with Trichinella, the carcass will be destroyed.

Notification system in place

Trichinosis is compulsory notifiable.

National evaluation of the recent situation, the trends and sources of infection

Trichinosis in horses sent for slaughter has never been reported in Sweden.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

The risk of obtaining trichinosis from horses slaughtered in Sweden is negligble.

Table Trichinella in animals

	Source of information	Sampling unit	Units tested	Total units positive for Trichinella spp.	T. spiralis	Trichinella spp., unspecified
Pigs (1)	SVA	animal	3033740	0		
Solipeds, domestic						
horses (3)	SVA	animal	3009	0		
Wild boars						
wild (2)	SVA	animal	11226	0		
Foxes	SVA	animal	202	2		2
Bears (4)	SVA	animal	108	0		
Lynx	SVA	animal	70	3		3
Wolves	SVA	animal	9	2		2
Other animals	SVA	animal	29	0		

(1) : all slaughtered animals
(2) : all slaughtered animals, wild and farmed wild boars
(3) : all slaughtered animals
(4) : all slaughtered animals

2.9. ECHINOCOCCOSIS

2.9.1. General evaluation of the national situation

A. Echinococcus spp. general evaluation

History of the disease and/ or infection in the country

The last diagnosed cases of E. granulosus in animals was in 1997 (one reindeer) and 2000 (one moose). E. multilocularis has never been diagnosed in the country.
Notification of echinococcosis in humans was initiated in 1994 and since then 3-14 cases have been reported annually, all assumed to have been infected abroad.

National evaluation of the recent situation, the trends and sources of infection

The situation in Sweden remains stable, but as E. multilocularis spreads within Europe, a high awareness and risk mitigating measures are important. In 2006, a risk assessment of introducing E. multilocularis into Sweden from EU and the effect of anithelmintics was performed (see text "E. multilocularis").

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

E. multilocularis has never been diagnosed in Sweden and the risk of domestic infection is at present negligible. However, the risk assessment showed that there is a medium to high risk of introducing the parasite into Sweden from dogs and cats entering the country from EU. If introduced, it is likely that the parasite will establish itself within Sweden in wildlife reservoirs with serious consequences unless a strategy of antihelmintic is implemented and complied with.

Recent actions taken to control the zoonoses

Since 1994 all dogs that are brought in from countries other than Finland and Norway must be treated with praziquantel as a preventive measure.

Suggestions to the Community for the actions to be taken

Continuous treatment of dogs and cats prior to entering countries free from E. multilocularis from countries with the infection.

2.9.2. Echinococcosis in humans

A. Echinococcus spp. in humans

Reporting system in place for the human cases

Surveillance is based on passive case finding.

Case definition

A case is defined as a person in whom echinococcosis has been diagnosed.

Diagnostic/ analytical methods used

Histopathology or serology.

Notification system in place

Since 1st of July 2004 echinococcosis is a notifiable disease under the Communicable Disease Act (both from the laboratory and from the physician).

History of the disease and/ or infection in the country

Notification of echinococcosis (based on voluntary reports by laboratories) was initiated in 1994 and since then 3-14 cases have been reported annually, all are assumed to have been infected abroad.

Results of the investigation

In 2006, seven cases infected with E. granulosus were reported. Six cases were reported to having acquired their infection abroad and for one case the country of infection was not reported, but it was assumed to have been infected abroad as well.

National evaluation of the recent situation, the trends and sources of infection

Echinococcosis is not spread in the country, but sometimes persons, originating from places where the disease exists, are found being infected.

Relevance as zoonotic disease

Currently none of the Echinococcus species represents any threat to humans in Sweden. However, due to the spread of the tapeworm (E. multilocularis) in other European countries, including findings of the parasite in Denmark, the situation might change and an increased awareness is necessary. However, it can not be excluded that echinococcosis can be introduced through the increased illegal movement of dogs into Sweden, that has been seen during the last years.

2.9.3. Echinococcus in animals

A. E. granulosus in animal

Monitoring system

Sampling strategy

All food producing animals are macroscopically examined at slaughter. If there is a suspicion of echinococcosis, samples are investigated microscopically.
Samples from foxes are collected as part of annual investigations of around 300 foxes. Single necropsied, mainly wild wolves, may also be examined.

Type of specimen taken

Other: Feces and gut tissue from foxes and cyst material from intermediate hosts.

Methods of sampling (description of sampling techniques)

Samples of faeces and parts of the gut are collected from foxes at necropsy. In case of suspicion, cyst materials are collected from food producing animals at slaughter.

Case definition

A case is defined as an animal in which the parasite has been found.

Diagnostic/ analytical methods used

Other: In food producing animals surveillance is based on slaughter inspections. From foxes the contents of the intestine of 100 foxes are examined by parasitological technique. PCR may also be used.

Control program/ mechanisms

The control program/ strategies in place

In order to prevent the introduction of E. multilocularis, dogs that are brought in from countries other than Finland and Norway must be treated with praziquantel. This treatment also prevents additional introduction of E. granulosus.

Measures in case of the positive findings or single cases

If an animal is found infected with Echinococcus spp. the offal and carcass will be destroyed.

Notification system in place

Echinococcosis is a notifiable disease in all animals.

Results of the investigation

In 2006, neither E. granulosus or E. multilocularis was found at inspection of all slaughtered animals. 300 foxes were sampled and all were negative.

Additional 4 wolves that were subjected to necroscopy tested negative.
All slaughterd animal were investigated macroscopically, and microscopically if deemed necessary. All were negative.

National evaluation of the recent situation, the trends and sources of infection

Sporadic cases of E. granulosus infection have occurred in imported horses that most probably were infected abroad. In reindeer, E. granulosus infection was prevalent in northern Sweden during the 1970s when around 2% of the reindeer were found infected at slaughter. Based on these findings, the routines at meat inspection of reindeer were revised and organs not approved for consumption were destroyed. During 1986-96 there was no case diagnosed in reindeer, followed by 3 cases in 1996-97. From elks, there have been two positive findings of E. granulosus, one in the early 1980s in the southern part of Sweden and one in 2000 in the central part of the country.
Since 2001 there has been an annual investigation of 300-400 foxes in order to detect E. multilocularis and E. granulosus. None of the investigated animals have tested positive.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

The risk of obtaining domestic echinococcosis is negligible.

B. E. multilocularis in animal

Monitoring system

Sampling strategy

All food producing animals are macroscopically examined at slaughter. If there is a suspicion of echinococcosis, samples are investigated microscopically.
Samples from foxes are collected as part of annual investigations of around 200-400 foxes.
In addition, E. multilocularis will be look for when, mainly, wild wolves are examined post mortem.

Type of specimen taken

Other:

Methods of sampling (description of sampling techniques)

Samples of faeces and parts of the gut are collected from foxes at necropsy. In case of suspicion, cyst materials are collected from food producing animals at slaughter.

Case definition

A case is defined as an animal in which the parasite has been found.

Diagnostic/ analytical methods used

Other: In food producing animals surveillance is based on slaughter inspections, whereas the Copro-Elisa-test and sedimentation is used in foxes.

Control program/ mechanisms

The control program/ strategies in place

In order to prevent the introduction of E. multilocularis, dogs that are brought in from countries other than Finland and Norway must be treated with praziquantel.

Suggestions to the Community for the actions to be taken

Keeping the policy of treating dogs and cats entering the country with antihelmintics.

Measures in case of the positive findings or single cases

If an animal is found infected with Echinococcus spp. the offal will be destroyed. If E. multilocularis is found in Swedish animals, there would be a need of increased public awareness on this matter and an education campaign on the risk of exposure from wildlife would be started.

Notification system in place

Echinococcosis is a notifiable disease in all animals.

Results of the investigation

In 2006, neither E. granulosus or E. multilocularis was found in slaughtered animals. 300 foxes were sampled and all teted negative.
Additional 4 wolves that were subjected to necroscopy tested negative.
All slaughterd animal were investigated macroscopically, and microscopically if deemed necessary. All were negative.

National evaluation of the recent situation, the trends and sources of infection

E. multilocularis has never been reported in Sweden. Since 2001 there has been an annual investigation of 300-400 foxes in order to detect E. multilocularis and E. granulosus. All have been negative.
The EU Regulation 998/ 2003 gives a five year transition period for Sweden after which a new Community policy will be devised based on national reports including a risk assessment to the EC. Results from the assessment conducted 2006 shows that: 1)there is high risk for serious consequences if E. multilocularis is introduced into Sweden, 2) the number of infected dogs and cats introduced could be between 10-40 per year. However, the risk can be reduced to low or very low if a high compliance (>99%) to a policy of that all dogs or cats that could have been exposed to infected intermediate hosts are treated with antihelmintics before entering Sweden.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

The risk of obtaining domestic echinococcosis is negligible.

Table Echinococcus in animals

	Source of information	Sampling unit	Units tested	Total units positive for Echinococcus spp.	E. granulosus	E. multilocularis	Echinococcus spp., unspecified
Cattle (bovine animals) (1)	SVA, SJV	animal	465225	0			
Sheep (2)	SVA, SJV	animal	212548	0			
Goats (3)	SVA, SJV	animal	560	0			
Pigs (4)	SVA, SJV	animal	3033740	0			
Solipeds, domestic (5)	SVA, SJV	animal	3009	0			
Reindeers (6)	SVA, SJV	animal	71633	0			
Foxes (7)	SVA	animal	300	0			
Wolves							
wild	SVA	animal	4	0			

(1) : macroscopic investigation of all slaughtered animals
(2) : macroscopic investigation of all slaughtered animals
(3) : macroscopic investigation of all slaughtered animals
(4) : macroscopic investigation of all slaughtered animals
(5) : macroscopic investigation of all slaughtered animals
(6) : macroscopic investigation of all slaughtered animals
(7) : annual screening

2.10. TOXOPLASMOSIS

2.10.1. General evaluation of the national situation

A. Toxoplasmosis general evaluation

History of the disease and/ or infection in the country

Toxoplasmosis is not notifiable in animals. However, serological studies in the 1990s showed that a large proportion of Swedish cats, dogs, foxes, sheep and a smaller number of pigs were seropositive. Since the first of July 2004 toxoplasmosis in humans is not a notifiable disease under the Communicable Disease Act. During the last 10 years before that between 4 and 18 human cases were reported annually, mainly in immuno-suppressed persons and in pregnant women.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

There is little information about the most common sources of infection, however undercooked or raw meat is considered important.

2.10.2. Toxoplasmosis in humans

A. Toxoplasmosis in humans

Reporting system in place for the human cases

Since the first of July 2004, toxoplasmosis is no longer a notifiable disease under the Communicable Disease Act.

Case definition

A case is defined as a person in whom toxoplasmosis has been verified.

Diagnostic/ analytical methods used

Antibody detection in serum and cerebro-spinal fluid by direct agglutination, IFL and immunosorbent agglutination assay.
Nucleic acid amplification test.

Notification system in place

Since the first of July 2004 toxoplasmosis is not a notifiable disease under the Communicable Disease Act.

History of the disease and/ or infection in the country

During the last 10 years between 4 and 18 cases have been reported annually. In 2003, 17 cases were reported. Of these, 8 were known to be of domestic origin. In 2004, 5 cases were reported. From the first of July in 2004 there is no mandatory reporting of toxoplasmosis.

Results of the investigation

Relevance as zoonotic disease

Clinical toxoplasmosis is most important in immuno-suppressed persons and in pregnant women. The infection can be transmitted from the mother to the foetus and cause serious and fatal injury. There is little information about the most common sources of infection, however undercooked or raw meat is considered important.
As a preventive measure for pregnant women it is recommended that they refrain from cleaning up faeces from cats.

2.10.3. Toxoplasma in animals

A. T. gondii in animal

Monitoring system

Sampling strategy

There is no official surveillance for Toxoplasma spp in animals. Sampling, mainly of sheep, goats, cats or dogs, is performed in case of clinical suspicion of toxoplasmosis.

Notification system in place

Toxoplasmosis is not notifiable in animals.

National evaluation of the recent situation, the trends and sources of infection

Results for toxoplasma investigations were previously reported when a majority of the samples were analysed at the SVA. Nowadays, it is not known how large proportion of samples being analysed at other laboratories and, therefore, results for toxoplasmosis has been omitted.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

A risk of contracting domestic Toxoplasma spp infection does exist. However, the relevance of clinical toxoplasmosis is most important in immunosuppressed persons and in pregnant women.

2.11. RABIES

2.11.1. General evaluation of the national situation

A. Rabies general evaluation

History of the disease and/ or infection in the country

The Swedish animal population has been free from rabies since 1886.

National evaluation of the recent situation, the trends and sources of infection

The national situation is stable. However, there are concerns about the risk of introducing rabies through the increased number of dogs that are brought into the country illegally.

Recent actions taken to control the zoonoses

The special provisions that Sweden has in the current legislation of movement of dogs and cats is under evaluation. For information about conducted risk assessment, see "Rabies in dogs".

2.11.2. Rabies in humans

A. Rabies in humans

Reporting system in place for the human cases

Surveillance is based on passive case finding.

Case definition

A case is a person with positive rabies diagnostic.

Diagnostic/ analytical methods used

Serology, antigen detection and isolation of the virus.

Notification system in place

Rabies is a notifiable disease under the Communicable Disease Act (both from the laboratory and from the physician).

History of the disease and/ or infection in the country

Two persons, one in 1974 and one in 2000, contracted rabies after having had contact with dogs in India and Thailand, respectively. Apart from that, there have been no human cases reported in modern times.

Results of the investigation

No human case of rabies was reported.

Relevance as zoonotic disease

As Sweden is free from rabies in animals since 1886 and import of animals is strictly regulated, the risk of contracting rabies in Sweden is negligible. However, it can not be excluded that rabies can be introduced through the increased illegal movement of dogs into Sweden, that has been seen during the last years.

2.11.3. Lyssavirus (rabies) in animals

A. Rabies in dogs

Monitoring system

Sampling strategy

The surveillance of rabies in Sweden is passive. Animals that are brought into the country illegally are tested for rabies, if they are euthanised. Also, there is a passive surveillance of bats and other wildlife sent in to the SVA.

Frequency of the sampling

Sampling is performed when there is a suspicion of rabies.

Type of specimen taken

Organs/ tissues: imprints from brain tissue

Methods of sampling (description of sampling techniques)

Specimens from brain tissue are analysed as soon as possible after collection.

Case definition

A case is defined as an animal from which rabies virus has been detected.

Diagnostic/ analytical methods used

Other: fluorescent antibody test (FAT) performed on smears from hippocampus or medulla oblongata, and mouse inoculation test as a complementary test

Vaccination policy

Vaccination of animals is allowed but usually only traveling dogs and cats are vaccinated. Dogs and cats that are brought into the country has to be tested for levels of protective antibodies following vaccination.

Control program/ mechanisms

The control program/ strategies in place

Recent actions taken to control the zoonoses

Since the number of dogs that are brought into the country, both legally and illegally, has increased an assessment of the risks involved is needed. A risk assessment regarding the risk of introducing rabies with illegally imported dogs was performed 2005. The risk was assessed as low and dependent on the origin of the dogs and number of dogs imported. A risk assessment regarding legally imported dogs and cats from the rest of EU was completed during summer 2006. The risk was assessed as very low.

Suggestions to the Community for the actions to be taken

One suggestion is to have import restrictions on dogs from areas where rabies virus strains are adapted to dogs.

Measures in case of the positive findings or single cases

If rabies were diagnosed, measures to eradicate the disease would be taken in accordance with the Swedish Act of Epizootics.

Notification system in place

Rabies is notifiable on clinical suspicion

Results of the investigation

Four dogs were investigated and all were negative.

National evaluation of the recent situation, the trends and sources of infection

Rabies has not occurred in Sweden since 1886. Dogs and cats from EU, EFTA countries and certain third countries (EU998/ 2003)can be brought into Sweden after rabies vaccination and antibody titre control, whereas dogs and cats from other countries have to be kept in quarantine for four months. Presently there is a great concern about increased number of illegally imported dogs into Sweden.

Additional information

Other animal species that were tested in 2006 were: 26bats, 4 cats, 2 minks and 1 cattle, fox and squirrel, respectively. All were negative.
Veterinarians and the public are advised to send bats are found dead to the SVA for rabies investigation, and hunters are encouraged to notify SVA about wildlife that behave in a way that rabies might be suspected.
In 1987-89 and 1999, surveys were performed where sick (n=75) or dead bats (n=200) were investigated for rabies, all were negative. Between 1998 and 2005, 322 bats were investigated and all were negative.

Table Rabies in animals

	Source of information	Sampling unit	Units tested	Total units positive for Lyssavirus (rabies)	unspecified Lyssavirus	European Bat Lyssavirus - unspecified	classical rabies virus (genotype 1)
Cattle (bovine animals)	SVA	animal	1	0			
Dogs	SVA	animal	4	0			
Cats	SVA	animal	4	0			
Bats							
wild	SVA	animal	26	0			
Foxes							
wild	SVA	animal	1	0			
Minks	SVA	animal	2	0			
Squirrels	SVA	animal	1	0			

2.12. Q-FEVER

2.12.1. General evaluation of the national situation

2.12.2. Coxiella (Q-fever) in animals

3. INFORMATION ON SPECIFIC INDICATORS OF ANTIMICROBIAL RESISTANCE

3.1. ENTEROCOCCUS, NON-PATHOGENIC

3.1.1. General evaluation of the national situation

3.1.2. Antimicrobial resistance in Enterococcus, non-pathogenic isolates

A. Antimicrobial resistance of Enterococcus spp., unspecified in animal

Sampling strategy used in monitoring

Frequency of the sampling

Antimicrobial resistance in enterococci from healthy animal is regularly monitored in the Swedish Veterinary Antimicrobial Resistance Monitoring programme (SVARM).
In 2006, isolates from dairy cows were tested.

Type of specimen taken

Intestinal content (caecum or colon) from dairy cows were sampled. Each animal is from a unique dairy herd.

Methods of sampling (description of sampling techniques)

In all 461 samples were collected from 11 abattoirs. The abattoirs accounted for 84% of the total volume of dairy cows slaughtered in Sweden in 2005. The number of samples collected at each abattoir was proportional to the slaughter volume of the abattoir.

Procedures for the selection of isolates for antimicrobial testing

All isolates (13 E. faecalis and 98 E. faecium) obtained from culture of the 470 samples were tested for antimicrobial susceptibility. Each isolate is from a unique dairy herd.

Methods used for collecting data

Results of antimicrobial susceptibility testing and information on origin of isolates were stored in a database at SVA. For compiling statistics, relevant data were extracted from the database.

Laboratory methodology used for identification of the microbial isolates

Isolation and antimicrobial susceptibility testing was performed at the National Veterinary institute
For samples from cows, 0.5 g colon content was diluted in 4.5 mL saline. From the dilution, 0.1 mL was spread onto Slanetz-Bartley (SlaBa) agar. The plates were incubated for 48 h at 37°C. One colony, randomly chosen, was sub-cultured on bile-esculin agar and blood agar (37°C, 24 h). Colonies with a morphology consistent with enterococci, and with a positive reaction on bile-esculin agar were tested for antimicrobial susceptibility and identified to species level according to Devriese et al. (1993) by use of the following biochemical tests: mannitol, sorbitol, arabinose, saccharose, ribose, raffinose and methyl-a-D-glucopyranoside.
Antimicrobial susceptibility was tested using dilution methods in cation adjusted Mueller-Hinton broth (CAMBH). The tests were performed following the standards for microdilution of the National Committee of Clinical Laboratory Standards (NCCLS, 2002) using VetMIC panels produced at the Dept. of Antibiotics, SVA. As quality control, Enterococcus faecalis ATCC 29212 was included.

Laboratory used for detection for resistance

Antimicrobials included in monitoring

For antimicrobials tested and range of tested concentrations see Table ”Breakpoints used for antimicrobial susceptibility testing of Enterococcus spp.in Animals”.

Preventive measures in place

No preventive measures are in place regarding enterococci from healty animals.

Control program/ mechanisms

The control program/ strategies in place

No control program is in place.

Recent actions taken to control the zoonoses

No measures are taken in case of antimicrobial resistance in commensal enterococci.

Results of the investigation

Antimicrobial resistance in enterococci from dairy cows was rare.

National evaluation of the recent situation, the trends and sources of infection

The situation is most favourable regarding antimicrobial resistance in commensal enterococci from dairy cows. This is in agreement with a previous study in 2000 in yearling cattle. Also the situation among isolates from slaughter pigs and broilers previously studied in SVARM is favourable.

Table Antimicrobial susceptibility testing of E. faecium in Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring - quantitative data [Dilution method]

Number of resistant isolates (n) and number of isolates with the concentration µl/ ml) or zone (mm) of inhibition equal to	E. faecium Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring
Isolates out of a monitoring programme	yes
Number of isolates available in the laboratory	98

Antimicrobials:	**N**	**n**	**<=0.03**	**0.06**	**0.12**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**>2048**	**lowest**	**highest**
Tetracyclines																						
Tetracyclin	98	3					61	34					3								0.5	64
Amphenicols																						
Chloramphenicol	98	0							1	24	71	2									0.5	64
Aminoglycosides																						
Streptomycin	98	0										3	34	61							8	1024
Gentamicin	98	0							3	33	56	6									2	256
Kanamycin	98	0										4	36	28	20	7	3				16	2048
Macrolides																						
Erythromycin	98	7					29	24	13	25	7										0.5	64
Glycopeptides (Cyclic peptides, Polypeptides)																						
Bacitracin	98	1						1	1	3	16	65	11	1							1	128
Vancomycin	98	0						74	10	14											1	128
Ionophores																						
Narasin	98	0				1	36	54	7												0.12	16
Oxazolidines																						
Linezolid	98	0						2	77	19											0.5	16
Penicillins																						
Ampicillin	98	0				10	30	45	13												0.25	32
Streptogramins																						
Virginiamycin	98	0					25	16	18	38	1										0.5	64

Table Antimicrobial susceptibility testing of E. faecium - qualitative data

n = Number of resistant isolates		
	E. faecium	
	Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring	
Isolates out of a monitoring programme	yes	
Number of isolates available in the laboratory	98	
Antimicrobials:	**N**	**n**
Tetracyclines		
Tetracyclin	98	3
Amphenicols		
Chloramphenicol	98	0
Aminoglycosides		
Streptomycin	98	0
Gentamicin	98	0
Kanamycin	98	0
Macrolides		
Erythromycin	98	7
Glycopeptides (Cyclic peptides, Polypeptides)		
Bacitracin	98	1
Vancomycin	98	0
Ionophores		
Narasin	98	0
Oxazolidines		
Linezolid	98	0
Penicillins		
Ampicillin	98	0
Streptogramins		
Virginiamycin	98	1
Fully sensitive	98	87
Resistant to 1 antimicrobial	98	10
Resistant to 2 antimicrobials	98	1

Footnote

For virginiamycin the EUCAST breakpoint >4 was used. This could not be indicated in the Breakpoint table.

Table Antimicrobial susceptibility testing of E. faecalis - qualitative data

n = Number of resistant isolates		
	E. faecalis	
	Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring	
Isolates out of a monitoring programme	yes	
Number of isolates available in the laboratory	13	
Antimicrobials:	**N**	**n**
Tetracyclines		
Tetracyclin	13	2
Amphenicols		
Chloramphenicol	13	0
Aminoglycosides		
Streptomycin	13	0
Gentamicin	13	0
Kanamycin	13	0
Macrolides		
Erythromycin	13	0
Glycopeptides (Cyclic peptides, Polypeptides)		
Bacitracin	13	0
Vancomycin	13	0
Ionophores		
Narasin	13	1
Oxazolidines		
Linezolid	13	0
Penicillins		
Ampicillin	13	0
Streptogramins		
Virginiamycin	13	0
Fully sensitive	13	10
Resistant to 1 antimicrobial	13	3

Table Antimicrobial susceptibility testing of E. faecalis in Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring - quantitative data [Dilution method]

Number of resistant isolates (n) and number of isolates with the concentration µl/ ml) or zone (mm) of inhibition equal to	E. faecalis
	Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring
Isolates out of a monitoring programme	yes
Number of isolates available in the laboratory	13

Antimicrobials:	**N**	**n**	**<=0.03**	**0.06**	**0.12**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**>2048**	**lowest**	**highest**
Tetracyclines																						
Tetracyclin	13	2					10	1					1	1							0.5	64
Amphenicols																						
Chloramphenicol	13	0								4	9										0.5	64
Aminoglycosides																						
Streptomycin	13	0											2	10	1						8	1024
Gentamicin	13	0								2	3	8									2	256
Kanamycin	13	0											1	11		1					16	2048
Macrolides																						
Erythromycin	13	0					4	3	3	3											0.5	64
Glycopeptides (Cyclic peptides, Polypeptides)																						
Bacitracin	13	0							1		5	6	1								1	128
Vancomycin	13	0						5	4	4											1	128
Ionophores																						
Narasin	13	1				1	5	4	2		1										0.12	16
Oxazolidines																						
Linezolid	13	0							11	2											0.5	16
Penicillins																						
Ampicillin	13	0					3	8	2												0.25	32
Streptogramins																						
Virginiamycin	13	0							2	3		7	1								0.5	64

Table Breakpoints for antibiotic resistance of Enterococcus, non-pathogenic in Animals

Test Method Used

Disc diffusion

Agar dilution

Broth dilution

E-test

Standards used for testing

NCCLS

Enterococcus, non-pathogenic	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Amphenicols										
Chloramphenicol	EUCAST	32		32	0.5	64				
Tetracyclines										
Tetracyclin	EUCAST	2		2	0.5	64				
Aminoglycosides										
Streptomycin	EUCAST	512		512	8	1024				
Gentamicin	EUCAST	32		32	2	256				
Kanamycin	SVARM	1024		1024	16	2048				
Macrolides										
Erythromycin	EUCAST	4		4	0.5	64				
Glycopeptides (Cyclic peptides, Polypeptides)										
Bacitracin	EUCAST	32		32	1	128				
Vancomycin	EUCAST	4		4	1	128				
Oxazolidines										
Linezolid	EUCAST	4		4	0.5	16				
Penicillins										
Ampicillin	EUCAST	4		4	0.25	32				
Streptogramins										
Virginiamycin	EUCAST	32		32	0.5	64				
Ionophores										
Narasin	EUCAST	2		2	0.12	16				

Footnote

The EUCAST breakpoints for virginiamycin, narasin and streptomycin differs between E. faecalis and E. faecium. It was not possible to indicate this in the table. Therefore the breakpoint for E. faeclis is given.

3.2. ESCHERICHIA COLI, NON-PATHOGENIC

3.2.1. General evaluation of the national situation

3.2.2. Antimicrobial resistance in Escherichia coli, non-pathogenic isolates

A. Antimicrobial resistance of E. coli in animal - Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring

Sampling strategy used in monitoring

Frequency of the sampling

Antimicrobial resistance in E. coli from healthy animal is regularly monitored in the Swedish Veterinary Antimicrobial Resistance Monitoring programme (SVARM). In 2006, isolates from dairy cows were tested.

Type of specimen taken

Intestinal content (caecum or colon) from dairy cows were sampled. Each animal is from a unique dairy herd.

Methods of sampling (description of sampling techniques)

In all 365 samples were collected from 11 abattoirs. The abattoirs accounted for 84% of the total volume of dairy cows slaughtered in Sweden in 2005. The number of samples collected at each abattoir was proportional to the slaughter volume of the abattoir.

Procedures for the selection of isolates for antimicrobial testing

All isolates (314) obtained from culturee of the 365 samples were tested for antimicrobial susceptibility. Each isolate is from a unique dairy herd.

Methods used for collecting data

Results of antimicrobial susceptibility testing and information on origin of isolates were stored in a database at SVA. For compiling statistics, relevant data were extracted from the database.

Laboratory methodology used for identification of the microbial isolates

Isolation and antimicrobial susceptibility testing was performed at the National Veterinary institute. Approximately 0.5 g of ceacal content was diluted in 4.5 mL phosphate buffered saline (PBS, pH 7.2). After thorough mixing, 0.1 mL of this suspension was spread on MacConkey agar. After incubation overnight at 37°C, one lactose positive colony with morphology typical for E. coli was sub-cultured on horse-blood agar (5% v/ v), after which the isolate was tested for production of tryptofanase (indole) and b-glucuronidase (p-nitrophenyl-b-D- glucopyranosiduronic acid, PGUA). Only lactose-positive isolates with typical morphology and positive reactions in both tests were selected for susceptibility tests.

Laboratory used for detection for resistance

Antimicrobials included in monitoring

Antimicrobial susceptibility was tested using dilution methods in cation adjusted Mueller-Hinton broth (CAMBH). The tests were performed following the standards for

microdilution of the National Committee of Clinical Laboratory Standards (NCCLS, 2002) using VetMIC panels produced at the Dept. of Antibiotics, SVA. As quality control, Escherichia coli ATCC 25922 was included.

Breakpoints used in testing

For antimicrobials tested and range of tested concentrations see Table ”Breakpoints used for antimicrobial susceptibility testing of E. coli in Animals”.

Preventive measures in place

No preventive measures are in place regarding E. coli from healty animals.

Control program/ mechanisms

The control program/ strategies in place

No control program is in place.

Measures in case of the positive findings or single cases

No measures are taken in case of antimuicrobial resistance in commensal E. coli.

Notification system in place

No notification system is in place in case of antimicrobial resistance in commensal E. coli.

Results of the investigation

Antimicrobial resistance in commensal E. coli from dairy cows was extremely rare.

National evaluation of the recent situation, the trends and sources of infection

The situation is most favourable regarding antimicrobial resistance in commensal E. coli from dairy cows. This is in agreement with a previous study in 2000 in yearling cattle. Also the situation among isolates from slaughter pigs and broilers previously studied in SVARM is favourable.

Table Antimicrobial susceptibility testing of E. coli in animals

n = Number of resistant isolates	E. coli							
	Cattle (bovine animals)		**Pigs**		**Gallus gallus (fowl)**		**Turkeys**	
Isolates out of a monitoring programme	yes							
Number of isolates available in the laboratory	314							
Antimicrobials:	**N**	**n**	**N**	**n**	**N**	**n**	**N**	**n**
Tetracyclines								
Tetracyclin	314	5						
Amphenicols								
Chloramphenicol	314	0						
Florfenicol	314	0						
Cephalosporins								
Cefotaxim	314	0						
Ceftiofur	314	0						
Fluoroquinolones								
Ciprofloxacin	314	2						
Quinolones								
Nalidixic acid	314	2						
Sulfonamides								
Sulfonamide	314	5						
Trimethoprim	314	1						
Aminoglycosides								
Streptomycin	314	6						
Gentamicin	314	3						
Kanamycin	314	1						
Penicillins								
Ampicillin	314	0						
Fully sensitive	314	301						
Resistant to 1 antimicrobial	314	8						
Resistant to 2 antimicrobials	314	1						
Resistant to 3 antimicrobials	314	3						
Resistant to 4 antimicrobials	314	1						
Resistant to >4 antimicrobials	314	0						

Footnote

In calculations of multiresistance, nalidixic acid and ciprofloxacin were regarded as one substance. "Bovine animals" in this table are adult dairy cows

Table Antimicrobial susceptibility testing of E. coli in Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring - quantitative data [Dilution method]

Number of resistant isolates (n) and number of isolates with the concentration µl/ ml) or zone (mm) of inhibition equal to																						
	E. coli																					
	Cattle (bovine animals) - dairy cows - at slaughterhouse - animal sample - Monitoring																					
Isolates out of a monitoring programme	yes																					
Number of isolates available in the laboratory	314																					
Antimicrobials:	**N**	**n**	**<=0.03**	**0.06**	**0.12**	**0.25**	**0.5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**>2048**	**lowest**	**highest**
Tetracyclines																						
Tetracyclin	314	5					1	206	100	2			1	1	3						0.5	64
Amphenicols																						
Chloramphenicol	314	0							39	236	39										1	128
Florfenicol	314	0								162	152										4	32
Cephalosporins																						
3rd generation cephalosporins	0	0																				
Cefotaxim	314	0		210	100	4															0.06	2
Ceftiofur	314	0			21	122	163	8													0.12	16
Fluoroquinolones																						
Ciprofloxacin	314	2	231	81			1		1												0.03	1
Enrofloxacin	0	0																				
Quinolones																						
Nalidixic acid	314	2						12	61	224	15			1		1					1	128
Sulfonamides																						
Sulfonamide	314	5										249	58	2						5	16	2048
Trimethoprim	314	1				145	160	7	1					1							0.25	32
Aminoglycosides																						
Streptomycin	314	6								47	241	20	1	2	2		1				2	256
Gentamicin	314	3					67	217	27	3											0.5	64
Neomycin	0	0																				
Kanamycin	124	1							12	100	11	1									2	16
Penicillins																						
Ampicillin	314	0				1	12	54	161	65	21										0.25	32
Trimethoprim + sulfonamides	0	0																				

Table Breakpoints used for antimicrobial susceptibility testing in Animals

Test Method Used

Disc diffusion

Agar dilution

Broth dilution

E-test

Standards used for testing

NCCLS

Escherichia coli, non-pathogenic	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Amphenicols										
Chloramphenicol	EUCAST	16		16	1	128				
Florfenicol	EUCAST	16		16	4	32				
Tetracyclines										
Tetracyclin	EUCAST	8		8	0.5	64				
Fluoroquinolones										
Ciprofloxacin	SVARM	0.06		0.06	0.03	1				
Enrofloxacin										
Quinolones										
Nalidixic acid	EUCAST	16		16	1	128				
Trimethoprim	EUCAST	2		2	0.25	32				
Sulfonamides										
Sulfonamide	NCCLS	256		256	16	2048				
Aminoglycosides										
Streptomycin	EUCAST	16		16	2	256				
Gentamicin	EUCAST	2		2	0.5	64				
Neomycin										
Kanamycin	EUCAST	8		8	2	16				
Trimethoprim + sulfonamides										
Cephalosporins										
Cefotaxim	EUCAST	0.25		0.25	0.06	2				
Ceftiofur	EUCAST	1		1	0.12	16				
3rd generation cephalosporins										
Penicillins										
Ampicillin	EUCAST	8		8	0.25	32				

Table Breakpoints used for antimicrobial susceptibility testing in Food

Test Method Used

- Disc diffusion
- Agar dilution
- Broth dilution
- E-test

Standards used for testing

Escherichia coli, non-pathogenic	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Amphenicols										
Chloramphenicol										
Florfenicol										
Tetracyclines										
Tetracyclin										
Fluoroquinolones										
Ciprofloxacin										
Enrofloxacin										
Quinolones										
Nalidixic acid										
Trimethoprim										
Sulfonamides										
Sulfonamide										
Aminoglycosides										
Streptomycin										
Gentamicin										
Neomycin										
Kanamycin										
Trimethoprim + sulfonamides										
Cephalosporins										
Cefotaxim										
Ceftiofur										
3rd generation cephalosporins										
Penicillins										
Ampicillin										

Table Breakpoints used for antimicrobial susceptibility testing in Feedingstuff

Test Method Used

Disc diffusion

Agar dilution

Broth dilution

E-test

Standards used for testing

Escherichia coli, non-pathogenic	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Amphenicols										
Chloramphenicol										
Florfenicol										
Tetracyclines										
Tetracyclin										
Fluoroquinolones										
Ciprofloxacin										
Enrofloxacin										
Quinolones										
Nalidixic acid										
Trimethoprim										
Sulfonamides										
Sulfonamide										
Aminoglycosides										
Streptomycin										
Gentamicin										
Neomycin										
Kanamycin										
Trimethoprim + sulfonamides										
Cephalosporins										
Cefotaxim										
Ceftiofur										
3rd generation cephalosporins										
Penicillins										
Ampicillin										

Table Breakpoints used for antimicrobial susceptibility testing in Humans

Test Method Used

- Disc diffusion
- Agar dilution
- Broth dilution
- E-test

Standards used for testing

Escherichia coli, non-pathogenic	Standard for breakpoint	Breakpoint concentration (microg/ ml)			Range tested concentration (microg/ ml)		Disk content	Breakpoint Zone diameter (mm)		
		Susceptible <=	Intermediate	Resistant >	lowest	highest	microg	Susceptible >=	Intermediate	Resistant <=
Amphenicols										
Chloramphenicol										
Florfenicol										
Tetracyclines										
Tetracyclin										
Fluoroquinolones										
Ciprofloxacin										
Enrofloxacin										
Quinolones										
Nalidixic acid										
Trimethoprim										
Sulfonamides										
Sulfonamide										
Aminoglycosides										
Streptomycin										
Gentamicin										
Neomycin										
Kanamycin										
Trimethoprim + sulfonamides										
Cephalosporins										
Cefotaxim										
Ceftiofur										
3rd generation cephalosporins										
Penicillins										
Ampicillin										

4. INFORMATION ON SPECIFIC MICROBIOLOGICAL AGENTS

4.1. HISTAMINE

4.1.1. General evaluation of the national situation

4.1.2. Histamine in foodstuffs

4.2. ENTEROBACTER SAKAZAKII

4.2.1. General evaluation of the national situation

4.2.2. Enterobacter sakazakii in foodstuffs

4.3. STAPHYLOCOCCAL ENTEROTOXINS

4.3.1. General evaluation of the national situation

4.3.2. Staphylococcal enterotoxins in foodstuffs

5. FOODBORNE OUTBREAKS

Foodborne outbreaks are incidences of two or more human cases of the same disease or infection where the cases are linked or are probably linked to the same food source. Situation, in which the observed human cases exceed the expected number of cases and where a same food source is suspected, is also indicative of a foodborne outbreak.

A. Foodborne outbreaks

System in place for identification, epidemological investigations and reporting of foodborne outbreaks

The municipal environmental/ public health authorities are responsible for detecting and preventing diseases related to food and water. Ill persons and the overall epidemiological investigation are the responsibilities of the regional infectious disease authority and the general practitioner. The municipal environmental/ public health authorities are required to report the results of outbreak investigations to the Swedish National Food Administration (SLV)over the Internet. Based on the reports received, SLV and the Swedish Institute for Infectious Disease Control (SMI), prepare a yearly report which is also sent to the WHO Surveillance program for control of foodborne infections and intoxications in Europe.

Description of the types of outbreaks covered by the reporting:

The reporting covers both sporadic cases and outbreaks (i.e. two or more cases with similar symptoms associated with a food or a meal in common). In general, no distinction between family or general outbreaks is made.

Table Foodborne outbreaks in humans

Causative agent	General outbreak	Household outbreak	Total Number of persons			Food implicated			Type of evidence for implication of the food	Place where food was consumed	Contributing factors
			ill (in total)	died	in hospital	Food (sub)category	Suspected as a source	Confirmed as a source			
1	2	3	4	5	6	7			8	9	10
Bacillus - B. cereus	1		5			pasta		x	lab confirmed food	vending car	def in food prep
Clostridium - C. perfringens	1		20	0		meal	x		epidemiology	restaurant	
Escherichia coli, pathogenic - Verotoxigenic E. coli (VTEC) - VTEC O157	1		10	0		vegetables	x		epidemiology, lab confirmed in patients	kindergarten	
Food borne viruses - calicivirus (including norovirus)	1		7	0		meal	x		epidemiology, patients and personnel lab confirmed	restaurant	infected by kitchen personnel
Food borne viruses - calicivirus (including norovirus)	1		8	0		Chinese frozen raspberries	x		Calicivirus isolated from an earlier batch	household	deficiencies during production
Food borne viruses - calicivirus (including norovirus)	1		8	0		cake with cream	x		epidemiology, lab confirmed in patients	household	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus)	1		9	0		Frozen Chinese raspberries		x	epidemiology, lab confirmed in patients and food	household	deficiencies during production
Food borne viruses - calicivirus (including norovirus)	1		10	0		savoury	x		lab confirmed in patients and persons who handled food	household	infected by kitchen personnel
Food borne viruses - calicivirus (including norovirus)	1		15	0		sandwich	x		epidemiology, lab confirmed in patients	household	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus)	1		20	0		sandwich	x		epidemiology, lab confirmed in patients	restaurant	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus)	1		25	0		unknown			lab confirmed in patients	unknown	
Food borne viruses - calicivirus (including norovirus)	1		54	0		unknown			lab confirmed in patients	unknown	

Food borne viruses - calicivirus (including norovirus)	1		77	0		salad	x		epidemiology, lab confirmed in patients	household	deficiencies during production
Food borne viruses - calicivirus (including norovirus)	1		90	0	1	meals	x		epidemiology, lab confirmed in patients	institution for elderly	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		2	0		raspberries	x		epidemiology, lab confirmed in patients	school	deficiencies during production
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		9	0		meal	x		epidemiology, lab confirmed in patients	large-scale household	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		9	0		oysters	x		epidemiology, lab confirmed in patients	restaurant	deficiencies during production
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		10	0		meals	x		epidemiology, lab confirmed in patients	restaurant	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		10	0		raspberries	x		epidemiology	household	deficiencies during production
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		11	0		chicken salad	x		epidemiology	household	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		12	0		meal	x		epidemiology, lab confirmed in patients	household	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		12	0		raspberries	x		epidemiology, lab confirmed in patients	household	deficiencies during production
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		21	0		meal	x		epidemiology, lab confirmed in patients	restaurant	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		24	0		buffé	x		epidemiology, lab confirmed in patients	restaurant	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		35	0		mousse with raspberry sauce	x		epidemiology, lab confirmed in patients	household	deficiencies during production
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		37	0		meal	x		epidemiology, lab confirmed in patients	restaurant	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		40	0		catering buffées	x		epidemiology, lab confirmed in patients	household	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	1		55	1		cake with cream	x		epidemiology, lab confirmed in patients	household	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	2		5	0		mixed salads	x		epidemiology	restaurant	deficiencies in food handling
Food borne viruses - calicivirus (including norovirus) - norovirus (Norwalk-like virus)	4		39	0		unknown					

Histamine	1		2	0	escolar		x	laboratory confirmed in food, symptoms	household	storage temperature too high
Histamine	1		2	0	tuna fish	x		symptoms, type of fish	household	storage temperature too high
Histamine	1		2	0	tuna fish	x		symptoms, type of fish	restaurant	storage temperature too high
Histamine	1		20	0	escolar	x		symptoms, type of fish	restaurant	storage temperature too high
Salmonella - S. Bareilly	1		130	0	sprouts	x		epidemiology	Indian restaurant	food at room temp too long time
Salmonella - S. Enteritidis - Not typable	1		15	0	almonds	x		epidemiology	household	def during production
Salmonella - S. Give	1		53	0	unknown			lab confirmed in patients	unknown	
Salmonella - S. Kapemba	1		32	0	pork roast	x		epidemiology, laboratory confirmation of patients and personnel	restaurant	deficiencies in cleaning and heating of food
Salmonella - S. Muenchen (2)	1		32	0	pork roast	x		epidemiology, laboratory confirmation of patients and personnel	restaurant	deficiencies in cleaning and heating of food
Salmonella - S. Paratyphi B var. Java	1		17	0	unknown			lab confirmed in patients	unknown	
Salmonella - S. Stanley	1		13	0	lime leaves		x	epidemiology, laboratory confirmed in leaves and patients	household	deficiencies in preparation of food
Salmonella - S. Typhimurium - DT 104	1		32	0	pork roast	x		epidemiology, laboratory confirmation of patients and personnel	restaurant	deficiencies in cleaning and heating of food
Salmonella - S. Virchow (3)	1		130	0	sprouts	x		epidemiology	Indian restaurant	food at room temp too long time
Staphylococcus - S. aureus	1		2		hot chicken sandwich	x			cafe	deficiencies in food handling
Staphylococcus - S. aureus	1		2	0	beef fillet		x	lab confirmed in food, symptoms	restaurant	deficiencies in food handling
Staphylococcus - S. aureus	1		2	0	chicken		x	lab confirmed in food, symptoms	Japanese restaurant	deficiencies in food handling
Staphylococcus - S. aureus	1		2	0	pizza	x		epidemiology, symptoms	household	deficiencies in food handling

Staphylococcus - S. aureus	1		3	0		grilled chicken		x	lab confirmed in food, symptoms	household	deficiencies in food handling
Staphylococcus - S. aureus	1		3	0		meal	x		epidemiology, symptoms	restaurant	deficiencies in food handling
Staphylococcus - S. aureus	1		5			Christmas buffe	x		epidemiology, symptoms	restaurant	deficiencies in food handling
Staphylococcus - S. aureus	1		6	0		shellfish		x	lab confirmed in food, symptoms, epidemiology	restaurant	deficiencies in food handling
Unknown	1		2			peeled paranuts from Amazonas	x		epidemiology	household	deficiencies during production
Unknown	1		3			cake	x		epidemiology	vending bus	deficiencies in cleaning of tools in kitchen
Unknown	1		3			fried chicken	x		epidemiology	Chinese restaurant	deficiencies in cleaning and preparation of food
Unknown	1		3			fruit salad	x		suspected	restaurant	
Unknown	1		4			chicken meat balls	x		epidemiology, bad smell and taste	household (industry made meat balls)	
Unknown	1		4			fish soup	x		epidemiology	restaurant/ household	
Unknown	2		24			cold sauce	x		epidemiology	restaurant	deficiencies in food preparation
Unknown	4		20			savoury	x		epidemiology	large-scale household	Deficiencies in food handling
Unknown	4		21			mixed salad	x		epidemiology	restaurant	deficiencies in cleaning and food handling
Unknown	7		17			pizza	x		epidemiology/ suspected	pizzeria/ household	deficiencies in food handling
Unknown	8		20		1	kebab, hamburger	x		epidemiology, ill person in kitchen	hamburger bar, pizzeria	Deficiencies in food handling
Unknown	8		52			buffé	x		epidemiology	restaurant, catering (3)	deficiencies in food handling
Unknown	18		126		1	meals	x		epidemiology	restaurant/ household	deficiencies in food handling
Unknown	23		92			unknown					
Wax esters (from fish) (1)	1		2	0		butterfish/ escolar	x		symptoms, type of fish	restaurant	deficiencies in preparation of food
Wax esters (from fish)	1		2	0		butterfish/ escolar	x		symptoms, type of fish	restaurant	deficiencies in preparation of food

(1) : Illness caused by wax esters and histamine
(2) : The outbreak was caused by three serotypes: S. Typhimurium DT104, S. Muenchen and S. Kapemba
(3) : A total of 130 persons diseased in the outbreak caused by serotypes S. Bareilly and S. Virchow.