Report to the Commission

Trends and sources of zoonotic infections recorded in Sweden during 2000

2001-07-04

National Veterinary Institute

Swedish Board of Agriculture
National Food Administration
Swedish Institute for Infectious Disease Control

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INTRODUCTION

This report has been produced by the Swedish Zoonosis Center at the National Veterinary Institute (SVA) in co-operation with the Swedish Institute for Infectious Disease Control (SMI), the National Food Administration (NFA) and the Swedish Board of Agriculture (SBA).

The report includes zoonotic infections/agents occurring in animals, humans, feedstuffs and food.

The total number of animals, herds and number of slaughtered animals in Sweden, according to species, are outlined in table 12.1 and the human population is specified in table 12.2.

DEFINITIONS-

Animal data

Monitoring: Continuous system (active or passive) of collecting data.
Active monitoring: The system is based on targeted examinations
Passive monitoring: Only notification requirement

Notification: Passive system to collect data

Compulsory monitoring programme: The monitoring is based on a legal provision

Voluntary monitoring programme: The monitoring is done on a voluntary basis

Surveillance: Specific extension of monitoring with a view to taking appropriate control measures

Survey: An investigation in which information is systematically collected for a limited time period

Screening: A particular type of diagnostic survey. The presumptive identification of unrecognised disease or infection by the application of tests or examinations which can be applied rapidly.

Human data

Outbreak : An incident in which 2 or more persons experience a similar illness after ingestion of the same type of food, or after consumption of water from the same source, or where epidemiological evidence implicates the food or water as the source of illness

Household outbreak (family outbreak): An outbreak affecting 2 or more persons in the same private household

General outbreak: An outbreak affecting members of more than one private household or residents of an institution

Single case (sporadic case): A case of an illness (irrespective of the nature of the source)

Imported case :A case where the incubation period, clinical and epidemiological data suggest that infection was acquired in another country, and where there is no epidemiological evidence suggesting indigenous infection

Domestic case : A case where the incubation period, clinical and epidemiological data suggest indigenous infection

SURVEILLANCE AND NOTIFICATION

Animals

In addition to specific surveillance systems described the report, surveillance is also achieved by notification of clinical observations, laboratory findings and findings at meat inspection. In Sweden, certain diseases are notifiable already on the basis of a clinical suspicion. In such cases, an investigation to confirm the diagnosis must always be made.
Only the index case in each herd or flock (epidemiological unit) is reported.

Humans

There are two reporting systems for communicable diseases in Sweden:
i) Diseases that are notifiable under the Communicable Disease Act. These

diseases are reported by the physicians and by laboratories.
ii) Diseases that are reported on a voluntary basis by the laboratories.

Figures included in the present report are mainly based on notifications by physicians.

i) Before 2000, these two reporting systems have been analysed separately. In previous zoonosis reports only reports from physicians have been included as the laboratory reports only includes a minimum of information on reported cases. In the present report, both the total number of reported cases and cases where reports by physicians are available are included. Calculations on place of infection, age distribution will, as in previous years, be performed on cases where reports by physicians are available.

Food
The responsibility for the surveillance of the food-producing industry is divided between the National Food Administration (NFA) and the local municipalities. The NFA has the responsibility for all slaughterhouses and the large scale cutting and processing plants. The NFA is also responsible for all large scale dairies, fish plants, establishments handling eggs and egg products, all large scale establishments handling food of non-animal origin . The municipalities are in general responsible for small and medium sized establishments, shops and restaurants and for all water for human consumption. The two largest municipalities (Stockholm and Gothenburg) have a delegated responsibility even for large scale cutting and processing plants.
The local municipalities are supervised by the NFA.
There is currently no reporting system in place, where the NFA automatically obtains results from the microbiological investigations of food and food items performed in the local municipalities.

In addition to the above mentioned notification in animals the finding of *Salmonella* in food of animal origin as well as positive findings in official control is also notifiable.

MYCOBACTERIUM BOVIS

M. bovis in animals

Disease agent

Mycobacterium bovis and *Mycobacterium tuberculosis*

Surveillance/notification systems

Infection with *M. bovis* or *M. tuberculosis* is notifiable in all animal species on the basis of a clinical suspicion. For food producing animals, inspection at slaughter is the main surveillance system in place. Sweden was declared officially free from bovine tuberculosis in cattle herds according to Commission Decision 95/63/EC, replaced by Commission Decision 1999/467/EC.
Sweden fulfils the requirements laid down in Council Directive 64/432/EEC, Annex I, (4) and (5) amended by 98/99 /EC on control measures in officially tuberculosis free member states.

Methods used

Bacteriological culture and comparative skin fold tuberculin test (*M. avium* and *M. bovis* tuberculin).

Case definition used and epidemiological unit

A case is defined as a single animal from which *M. bovis* or *M. tuberculosis* has been isolated. The herd is the epidemiological unit.

Measures taken in case of isolation of M. bovis or M. tuberculosis

Should tuberculosis in food producing animals occur, relevant measures to eradicate the disease (including depopulation of the whole herd) would be

undertaken.

Epidemiological history

Sweden declared itself free from bovine tuberculosis in 1958 and is declared officially free from tuberculosis in bovine herds according to EU-legislation. The last case of tuberculosis in cattle was diagnosed in 1978. No cases have been reported in wildlife for more than 50 years. Tuberculosis was diagnosed in a herd of farmed deer in 1991. The source of infection was a consignment of fallow deer imported in 1987. No spread of the infection to any other animal species has been found. A total of 13 infected deer herds have been identified (the last one in 1997) and all have been depopulated. A voluntary control programme was introduced in 1994, relevant parts were outlined in the 1995 report. General movement restrictions apply for all deer herds that have not obtained tuberculosis free status. Live animals from these herds may only leave the farm if transferred directly to an abattoir.

Results of the investigations in 2000

Cattle (table 1.1.1.)
At meat inspection, 4 cattle and at autopsy 1 cattle with suspicious lesions were investigated for the presence of mycobacteria. Based on findings at histological investigations and direct smears tuberculosis could be ruled out. Culture for mycobacteria was not performed in any case.

Farmed deer (table 1.1.2.)
In December 2000, 551 (96%) out of the 574 farmed deer herds were affiliated to the control programme.
A total of 400 herds (70%) had obtained tuberculosis-free status. Of these, 98 by at least three whole herd tuberculin tests, 267 by slaughter and meat inspection of the whole herd and 35 new herds had been established, with deer from tuberculosis free herds.
Another 150 herds (26%) were affiliated to the control program but had not obtained tuberculosis-free status. Of these herds 18 had begun to tuberculin test their deer and 16 had begun to depopulate their herd.
A total of 24 herds (4%) were not affiliated to the control program.
No infected herds were found in 2000.
In all, samples from 22 deer were examined due to suspicion of mycobacterial infection. Bacteriological examination for the presence of *M. bovis* or *M. tuberculosis* was performed in nine cases. None were positive, but *M. avium* was isolated from five deer (originating from two herds).

Swine, sheep and goats (table 1.1.3.)
Samples from a total of 93 pigs, collected at meat inspection were examined for mycobacteria. Culture was performed in 67 cases. None were positive for the tuberculosis -complex, but samples from 57 animals yielded growth of *M. avium*.
Six sheep were investigated at a laboratory for mycobacteria. Four sheep were identified at meat inspection and two at autopsy. Of these one was cultured for mycobacteria with negative result. However as acid fast organisms were found the herd was tuberculin tested with a comparative tuberculintest. No bovine rectors were found but several avian reactors were identified.

Pets, wildlife and zoo animals (table 1.1.3.)
Samples from 1 horse, 5 dogs, 1 badger, 5 zoo animals and 6 other animals were investigated for mycobacteria. All samples were negative for the tuberculosis complex.

M. bovis in humans

Surveillance/ notification systems

Tuberculosis is a notifiable disease under the Communicable Diseases Act. Figures in this report are based on reports by

physicians and on laboratory reports[1]. The surveillance is mainly based on passive case findings. Screening by health control of foreign refugees and asylum seekers is recommended but not uniformly performed.

Laboratory criteria for diagnosis

Isolation of *M. bovis* from a clinical specimen or demonstration of *M. bovis* from a clinical specimen by nucleic acid amplification test.

Case definition

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

Results of the investigations in 1999 and 2000 (Table 1.3.)

Only preliminary figures for 2000 is available. Five cases of *M. bovis* have been reported. Four domestic cases, all elderly women (between 66 an 90 years old) were probably infected in Sweden prior to the eradication of *M.bovis* in the cattle population. The fifth cases was a middle aged man from Finland where the place of infection was unknown. There is no change in the trend from previous years. The final figures for 1999 are two reported cases of *M. bovis*. One elderly man was probably infected in Sweden before the eradication of *M. bovis* and one 30 year old man from South America was infected abroad.

Relevance as zoonotic disease

Almost all cases of *M. bovis* in humans in Sweden are infected abroad. Cases also occur in elderly people infected before *M. bovis* was eradicated from the Swedish cattle population. As Sweden is officially free from bovine tuberculosis, the risk of people contracting tuberculosis from Swedish animals is considered negligible. As very few cases of human tuberculosis due to *M. bovis* occur in Sweden and person to person spread of *M. bovis* is rare, the risk of contracting bovine tuberculosis from people in Sweden is judged to be negligible.

[1] See introduction

BRUCELLA ABORTUS / OVIS / SUIS / MELITENSIS

Brucella in animals

Disease agent

Brucella abortus, Brucella ovis, Brucella suis, Brucella melitensis.

Surveillance/ notification systems

Infection with *Brucella* spp. is notifiable in all animals on the basis of a clinical suspicion. Surveillance is also based on investigations of cases of abortion. In addition serological surveys in sheep and goats are performed according to EU-legislation. Serological surveys are also regularly performed in cattle and pigs. Sweden was declared officially free from brucellosis in cattle herds according to Commission Decision 95/74/EC, replaced by Commisission Decision 1999/466/EC. Sweden fulfils the requirements laid down in Council Directive 64/432/EEC, Annex II (7) and (8), amended by 98/99/EC on control measures in officially brucellosis free member states.

Methods used

In cattle, several methods are used. In dairy herds, tube agglutination, complement fixation or a milk ELISA are used. For beef cattle, swine, sheep and goats, a complement fixation test or a rose bengal plate test is used. If a clinical case is suspected, serology and bacteriology is used.

Case definition used and epidemiological unit

A case is defined as a single animal from which *Brucella spp*. has been isolated or an animal showing significant antibody

titres to *Brucella spp*. The herd is the epidemiological unit.

Vaccination policy

Vaccination is not allowed

Measures taken in case of brucella diagnosis.

Should brucellosis occur, relevant measures to eradicate the disease (probably including stamping out) would be taken.

Epidemiological history

The last case of bovine brucellosis was reported in 1957. Brucellosis in other species has never been found. Sweden has been declared free from brucellosis in bovines, sheep and goats according to EU-legislation. The conditions for an officially brucellosis-free status, according to EU-legislation, apply to all domestic food producing animals.

Results of the investigations in 2000
(Tables 2.1.1, 2.1.2 and 2.1.3)

A total of 3000 blood samples from beef cattle, originating from 1309 herds (representing 6.5% of all beef herds) were analysed with an indirect ELISA (Svanova, Biotech, Uppsala) for the presence of antibodies against *B. abortus*. All were negative.
Blood samples were collected from 3000 pigs and analysed with a tube agglutination test for antibodies against *Brucella suis.* All were negative.
In all, 9682 serum samples from sheep and goats were tested. The 8998 sheep samples originated from 365 herds (representing about 4-5% of all herds) and the 684 goat samples originated from 24 herds. The samples were tested for the presence of antibodies against *Brucella melitensis*, using the rose bengal plate test. All were negative.

In addition 1945 blood samples from pigs were tested for *Brucella suis*, 1146 blood samples from cattle were tested for *Brucella abortus* and 141 samples from sheep and goat were analysed for *Brucella abortus* with negative result. 38 blood samples from sheep (probably identical with those tested for *Brucella abortus)* were tested for *Brucella melitensis* and 48 for *Brucella ovis* with negative results. Blood samples from 156 other animals (including 56 dogs) were analysed for the presence of antibodies for *Brucella spp*. with negative results.

In addition investigations have been performed in three cattle herds and three pig herds due to clinical symptoms (abortions). All herds were negative. One cattle herd was investigated due to an unclear test result in cattle intended for export.

Brucella in humans

Surveillance/ notification systems

Brucellosis is not a notifiable disease under the Communicable Disease Act. Figures in this report are based on voluntary laboratory reports[2].

Case definition

A case is defined as a person where brucellosis has been verified by laboratory investigations (bacteriology or serology).

Epidemiological history

During the last 10 years between 0-6 cases has been reported each year. A domestic source of infection has not been found in any of these cases.

Results of the investigations in 2000
(Table 2.3)

During 2000 one case was reported. The person had contracted the disease abroad.

Relevance as zoonotic disease

There are very few cases of brucellosis in humans in Sweden. No source of infection

[2] See introduction

for human cases has been found in Sweden. The risk of obtaining brucellosis from domestic sources is negligible.

SALMONELLA

The Swedish salmonella control programme is not described in detail. The part of the programme that was approved by the Commission is described in Commission Decision 95/50/EC. [3]
Sweden has achieved an efficient control of *Salmonella*, despite the industrialisation of animal production. Due to the control, both red and white meat and table eggs produced in Sweden are virtually free from *Salmonella*. Surveillance, according to the Swedish salmonella control programme initiated in 1995, indicates that the overall prevalence is below 0.1%.

Any finding of *Salmonella*, irrespective of sero type, in animals, humans, feed and food of animal origin is notifiable[4]. In addition, findings of *Salmonella* in official sampling of food of any origin is notifiable. All primary isolates of *Salmonella* are characterized by sero- and phage typing the strains and isolates of animal origin are also tested for antibiotic resistance.

Action, including an investigation to clarify the source of infection, is always taken at any finding of *Salmonella*. Restrictions on animal movements are put on the farm. Restrictions are only lifted when the infection has been eliminated. Feed contaminated with *Salmonella* is destroyed or treated to eliminate the contamination. Food contaminated with *Salmonella* is destroyed or returned to the country of origin[5].

Salmonella in feedingstuffs

Surveillance/ notification systems

The salmonella control of feed has a long tradition in Sweden. Every year a large number of samples is taken in order to detect *Salmonella* and prevent it from entering the feed chain. At the feed mills samples are taken mainly according to HACCP principles (HACCP = Hazard Analysis Critical Control Point) . This system was initiated in 1991 and has proved to be effective for the prevention of *Salmonella*.
The feed control is supervised by the Swedish Board of Agriculture (SBA) and the samples are taken in accordance with Swedish legislation on feedingstuffs and the legislation on animal by-products. In addition to the compulsory testing, a large number of voluntary samples is taken.
In the feed sector it is compulsory to notify any findings of *Salmonella spp*. Positive findings shall, no matter if it has been a compulsory or a voluntary test, be reported immediately to the National Veterinary Institute (NVI) and at the same time be sent there for confirmation and serotyping.

Environmental sampling (HACCP sampling) at feed mills
Samples taken at feed mills mainly consist of samples taken at critical points on the premises and along the production line in accordance with HACCP principles. This system is believed to increase the chances of finding *Salmonella* compared to sampling of the feedingstuffs themselves.

The feed mill´s own checks
A feed mill that produces feedingstuffs for poultry is obliged to take at least five

[3] Information on the remaining parts of the salmonella control programme can be obtained from the Swedish Board of Agriculture.
[4] See ”surveillance systems” under ”feedstuffs”, ”animals”, ”food” and ”humans”.
[5] See ”measures taken in case of salmonella isolation” under ”feedstuffs”, ”animals”, ”food” and ”humans”.

samples a week from the following critical points: silo containing compound feedingstuffs, the area where the cooler is located (dust), the top of the cooler, central aspiration and elevator for feed material. For feed mills that only produce feedingstuffs for ruminants, pigs or horses, two samples a week is sufficient (from the silo and the elevator mentioned above). In addition to these samples the producer usually takes voluntary samples.

Sampling made at official inspections
Official feed inspectors visit the feed mills one to five times a year. (The frequency depends on the size of the feed mill.) During these visits a dustsample is taken in the top of a silo that contains compound feedingstuffs (especially feedingstuffs intended for poultry).
A "hygiene group" consisting of the county veterinarian and an official feed inspector once a year visits feed mills that have a production of more than 1000 tons a year. During these visits samples are taken at critical points - especially in connection with coolers, aspirators and elevators.

Sampling of feed materials and sampling in the production of feed materials
A categorisation of feed material has been made according to the *Salmonella* risk they may present. Feed material of animal origin is categorised as S1. Feed material of vegetable origin considered as high risk (for example soy and some products deriving from rapeseed) is categorised as S2 and vegetable low risk feed material (for instance husked rice) is categorised as S3. Only feed materials of the categories S1, S2 and S3 are sampled by routine.

Production
Every batch of feed material of animal origin produced has to be sampled. If there is a continuous production, the number of samples to be taken is decided by the SBA. The production of feed materials categorised as S1, S2 or S3 has to follow a hygiene programme approved by the SBA. The programme has to contain routines for *Salmonella* sampling.

Import
Feed materials categorised as S1, S2 and S3 have to be tested for *Salmonella*. A large amount of samples are taken from the consignment in accordance with a statistical model. The consignment can also be sampled in the country of origin. If so, it must be proved that the samples have been taken and that the results have been negative.

Sampling of imported compound feedingstuffs
Any kind of feedingstuffs containing S1, S2 or S3 destined for the feeding of ruminants, pigs or poultry has to be tested for *Salmonella* in accordance with the same principles as S1, S2 or S3 (see above).

Petfood
Every supplier of petfood is visited once a year by an official feed inspector, and a random sample for *Salmonella* detection is taken.
In addition to the samples taken at official inspections, voluntary samples are taken. Every consignment of dog chews coming from a third country is sampled at the border inspection post. In 2000 a survey was initiated to check the prevalence of *Salmonella* in dog chews deriving from the EU.
When petfood is imported it must be accompanied by a certificate showing that it has been tested for *Salmonella* in compliance with EU legislation with a negative result.

Methods used

The bacteriological method that is used to detect *Salmonella* is NMKL method No 71 (5^{th} ed., 1999). Certain serotypes are subtyped by molecular subtyping methods. Serotyping is performed by slide agglutination. Laboratories taking part in the feed control must be accredited for the

method.

Analysing laboratories
The compulsory samples taken at the feed mills have to be analysed at the NVI. Other samples may be analysed at other accredited laboratories. The samples taken by the official feed inspectors and the "hygiene group" are analysed at the NVI.

Measures taken in case of salmonella isolation

No feed material containing, or suspected of containing, *Salmonella* may be used in the production of feedingstuffs without the *Salmonella* first having been destroyed and new sampling showing that the feed material is free from *Salmonella*.
Positive *Salmonella* findings always give rise to further testing and decontamination in accordance with rules laid down in the legislation.

Heat treatment

All compound feedingstuffs for poultry have to be heat treated up to at least 75° C which is an effective way of preventing *Salmonella*. In practice almost all compound feedingstuffs for ruminants and pigs are heat treated as well.
Grain cannot be sold to a poultry farm as feed for poultry unless it has been heat treated or comes from a storage plant that has been approved by the SBA. In order to be approved the storage plant must fulfil certain requirements i.a. sampling at critical control points once a year.

Results of the investigations in 2000

(Tables 3.1.1 – 3.1.4)
In the tables only the compulsory samples and those of the voluntary samples that have been reported to the SBA have been registered. (There is no obligation to report negative results from voluntary samples.)

Feed material of vegetable origin
All feed materials of vegetable origin that have tested positive for *Salmonella* were imported. The isolates came from derived material of soy bean, maize, rape seed and palm kernel. The most common serotypes were *S.*Mbandaka, *S.*Senftenberg and *S.* Livingstone (table 3.1.4 c).

Feed mills and compound feedingstuffs
In the environmental control of feed mills 8336 samples have been reported taken. Most of these are within the compulsory sampling. 54 positive samples were found among those 8336 samples. The most common serotypes were *S.* Havana, *S.* Mbandaka and *S.* Senftenberg. (Table 3.1.4d)

Animal by-products processing plants and feed material of animal origin
The feed material of animal origin is sampled in accordance with to EU legislation. In addition many voluntary samples are taken.
Out of 6123 analysed samples there were 5 that were *Salmonella* positive.
135 of the 2655 analysed samples taken at critical control points were *Salmonella* positive. The figure includes follow up samples and samples taken at specific points because of suspected contamination. The most common serotypes were *S.* Agona, *S.* Mbandaka and *S.* Senftenberg. (Table 3.1.4b)

Salmonella Yoruba
S. Yoruba has been detected both in imported soy and in the environment at feed mills (before the heat treatment). As one pig farm and one poultry farm have been reported having *S.* Yoruba in 2000 and as feed is the suspected route for infection investigations have been made. *S.* Yoruba has never been found in compound feedingstuffs in Sweden and whether the bacteria can survive the heat treatment in the production of the compound feedingstuffs is not known.

Salmonella in animals

Surveillance/notification systems

Poultry and eggs

Any finding of *Salmonella*, irrespective of serotype, is notifiable. Sampling strategies are outlined in the Swedish salmonella control programme approved by the EU. All faecal samples are collected according to Council Directive 92/117/EEC. Microbiological sampling of breeding flocks is carried out according to Council Directive 92/117/EEC. In addition, more frequent testing is carried out in the grand parent generation. Elite breeding flocks does not occur in Sweden as layer and broiler breeders are imported as day-old grandparents. During the rearing period, sampling is done on 5 separate occasions. Tissue samples (caeca) are taken as a supplement to the faecal sampling. During egg production faecal samples are taken from the breeders every month as a supplement to the sampling in the hatchery.

The parent generation is tested during the rearing period by tissue sampling as well as faecal sampling. During egg production, samples are taken as has been described for grand parents.

Ratite breeders are tested every third month by faecal samples.

All meat producing flocks of broilers, turkeys, ducks, ratites and geese are investigated by faecal sampling 1-2 weeks before slaughter. In broilers additional sampling is carried out as 30 samples of caecal tissue are collected 1-2 weeks prior to slaughter.

Pullets (laying hens during rearing period) are tested (faecal samples) once during the rearing period, 2 weeks before moving to a laying unit. Sampling of laying flocks with more than 200 layers from establishments not placing eggs on the market and of all laying flocks from establishments placing their eggs on the market is carried out as faecal samples three times during production. Since April 1998, flocks of egg-producing quail are sampled twice a year by faecal sampling. Grand parents , parents and layers are sampled 2-4 weeks prior to slaughter.

Within to the control programme, neck skin samples are taken from poultry at slaughterhouses.

Cattle and pigs

Any finding of *Salmonella*, irrespective of serotype, is notifiable. Sampling strategies are outlined in the Swedish salmonella control programme approved by the EU. Sampling of slaughtered animals is carried out in all abattoirs. Samples consist of intestinal lymph nodes and swabs taken from parts of the carcass where the chances of finding *Salmonella* are considered optimal. All sanitary slaughtered animals are tested for *Salmonella*.

Faecal samples are collected annually in elite breeding herds, gilt-producing herds and twice annually in so-called sow pools. In addition to the *Salmonella* control programme, all weaner pig producing/integrated herds affiliated to a health control programme run by the industry, are tested by faecal samples collected annually. Samples for culture of *Salmonella* are also taken any clinical suspicion of *Salmonella* as well as at autopsies.

Sheep, goats and other food producing animals

Any finding of *Salmonella*, irrespective of serotype, is notifiable.

Method used

Bacteriological investigations are done according to NMKL No. 71 4th ed. 1991. A modification of ISO 6579:1993 is used, the most essential modification being the exclusion of the selenite broth enrichment step. Certain serotypes are subtyped by molecular subtyping methods. Serotyping is performed by slide agglutination.

Case definition and definition of epidemiological unit

A case is defined as a single animal from which *Salmonella* of any sero type has been isolated.

Poultry
The flock is the epidemiological unit. This is especially important as regards broilers, where 5-8 flocks may be raised annually in each house or compartment, and each flock is tested. The flock is also the unit, as regards measures taken. The strict hygiene rules that are implemented according to the Swedish prophylactic *Salmonella* control programme makes it possible to define the flock as the epidemiological unit.

Cattle and pigs and other food producing animals
The herd is usually the epidemiological unit.

Vaccination policy

Poultry
Vaccination of poultry against salmonellosis is not allowed.

Prophylactic measures

Poultry
Precautions must always be taken to avoid the introduction of *Salmonella* into poultry premises. Strict hygiene rules must be enforced through the whole production chain. Such rules have been implemented by the Swedish prophylactic *Salmonella* control programme. The programme includes:

- Rules for feed production and transport (HACCP process control, heat treatment, hygiene control).
- Hygiene rules to protect the poultry from *Salmonella* infection from the surroundings (restrictions for visitor, rodent control, hygiene barriers etc.).
- All in - all out systems in all categories of poultry production.

Cattle, pigs and other food producing animals
An efficient control of *Salmonella* (see ” *Salmonella* in animal feedstuffs”) ensures that feed to food producing animals is virtually free from *Salmonella*.

Measures taken in case of salmonella isolation

Poultry
All farms where *Salmonella* is found are put under restrictions, and after destruction of the flock, the premises/contaminated poultry houses are cleaned and disinfected. An investigation of the feed supplier involved is also initiated. Feedstuffs are destroyed or decontaminated.
Any poultry flock infected with *Salmonella*, irrespective of sero type isolated, will be destroyed.
Isolation of *Salmonella* in neck skins collected at slaughter is considered to be a contamination at slaughter and will lead to hygiene measures being taken at the slaughterhouse.
Cattle, pigs and other food producing animals
If *Salmonella* is isolated from an animal, indicating an infection in the herd of origin, action is always taken. This involves restrictions put on the herd. Animals are not allowed to enter or leave the herd, unless for sanitary slaughter. Samples are taken in the herd, for bacteriological investigation, and a sanitation plan is instituted, involving the elimination of chronically infected animals, cleaning and disinfection, manure and sludge treatment, disinfection or treatment of feedstuffs etc. An investigation of the feed supplier involved is also initiated. Restrictions are lifted when faecal samples from all animals in the epidemiological unit (usually the herd), taken at two consecutive sampling occasions one month apart, are negative. If swab samples from the carcasses of slaughtered animals are positive for *Salmonella*, hygiene measures are taken at the slaughterhouse.

Carcasses found to be contaminated with *Salmonella* are deemed unfit for human consumption.

Epidemiological history

The Swedish salmonella control programme was initiated in 1961 and it covers all food producing animals. In 1995, certain parts of the programme, covering cattle, pigs poultry and eggs, were approved by the EU (95/50/EC) and an extended surveillance programme was initiated. Results of the surveillance show that Swedish red and white meat and eggs are virtually free from *Salmonella*.
S. Typhimurium DT104 was first isolated in a cattle herd in 1995. From 1995 to December 2000 a total of four cattle herds have been found infected with this type of *Salmonella*. In all four cases the strains were penta resistant. One herd has been depopulated and the remaining herds have been cleared from *Salmonella* by normal routine measures taken by authorities. No pig herd or poultry flock has been found infected with *S.* Typhimurium DT104.

Results of investigations 2000 (Tables 3.2.1-3.2.4)

Poultry
The number of flocks investigated is outlined in tables 3.2.1 and 3.2.2. In all, 14 cases of *Salmonella* were nofitied during 2000 of which 4 were layers and 3 were broilers (figures 1 and 1.2) and 7 other meat producing flocks (geese, emu and duck). In layers *S.* Livingstone was isolated in 3 flocks and *S.* Yoruba in one flock. This is the second poultry herd where *S.* Yoruba has been identified. The first herd was a layer herd infected in 1999. *S* Yoruba has also for the first time been isolated in a pig herd. The increase in *S* Yoruba infected herds probably reflects a marked increase in the level of contamination observed in imported vegetable feed raw materials (soy bean meal).
Outbreaks in 3 broiler flocks were due to infection with *S*. Havana, *S*. Senftenberg and *S.* Mbandaka respectively. The two flocks infected with *S*. Senftenberg and *S.* Mbandaka were housed in the same house but reared during different time periods. The infections were identified in September and December respectively. In geese, *Salmonella* was isolated in 5 flocks, the isolated serotypes being *S.* Typhimurium DT 41 (n=2), *S.* Typhimurium DT40 (n=1) and *S.* Typhimurium NST (n=2). Additionally, one flock of emus was infected with *S.* Ebrie and one flock of ducks with *S.* Typhimurium NST.
S. Enteritidis or *S.* Typhimurium DT104 has not been isolated in poultry in 2000. None of these 3 NST strains had the same phage type pattern as the NST strains isolated in cats and wild passerine birds during 1999 (identified as *S.* Typhimurium U277 by Collindale).
Results of sampling of neck skins at slaughter are detailed in table 3.3.1 and figure 1.12.

Cattle and pigs
A summary of all animals/herds sampled for *Salmonella* according to the EU-approved Swedish salmonella control programme is outlined in table 3.2.3. Voluntary sampling in pig herds is also included. Sero- and phage types of all notified isolates are outlined in table 3.2.3. and 3.2.4.

Pigs
As can be seen in tables 3.2.3. and 3.2.4., figures 1.7, 1.8, 1.10 and 1.11., the *Salmonella* situation in pig continues to be very favourable. In 2000 a total of five pig herds were considered infected with *Salmonella* (table 3.2.3., 3.2.4.). All were identified within the EU-approved salmonella control program. This is a slight increase compared to 1998 and 1999 when only one and four herds respectively were notified (figure 1.4.). In 2000, *S.* Typhimurium DT 40 was isolated in two herds with fattening pigs and one breeding herd. This is a sero type found in wild passerine birds during winter/spring.

Infection in these herds might therefore be due to faecal contamination by wild passerine birds. The elite breeding herd was detected in the annual faecal sampling performed in all herds in the top of the breeding pyramid. However the infection could not be re-isolated in the herd despite two consecutive faecal sampling of all animals in the herd (with one month interval). However, the herd is still considered as a notified case as *Salmonella* was isolated in faeces from the herd. A similar case occurred in 1999 when *S.* Diarizonae was isolated in the annual faecal samples collected in a gilt producing herd and where the infection not could be re-isolated in the herd of origin. *S.* Typhimurium DT 41 was isolated in a fattening pig herd. In two samples from the infected herd *S.* Lexington was also isolated. *S.* Yoruba was isolated in a weaner pig producing herd (intended to become a gilt producing herd) in a faecal sample collected within the *Salmonella* surveillance program. This is the first time this sero type has been isolated in pigs in Sweden.
S. Typhimurium DT 104 has not been found in pigs during 2000.

Cattle
Results of the surveillance programme at slaughter houses (table 3.2.3., figures 1.6 and 1.9) and results of other surveillance (table 3.2.4.) show that the *Salmonella* situation continues to be very favourable in cattle.
In 2000 a total of 4 cattle herds were considered infected with *Salmonella* (table 3.2.3., 3.2.4., figure 1.3.). This is a decrease compared to 1998 and 1999 when 5 and 12 cases respectively were notified. In 2000, *S.* Dublin was isolated in 2 herds, *S.* Jangwani in one herd and *S.* Typhimurium DT15a in one herd. In 2 cases the infection was detected at autopsy and in one case both faecal samples and an aborted foetus was investigated. In the fourth case the infection was detected in the investigation performed due to a human case of salmonellosis (*S.* Typhimurium DT15a) in a milkmaid. This supports earlier investigations showing that autopsies (including *Salmonella* examinations) are important in the *Salmonella* surveillance in cattle under Swedish conditions. In the herd infected with *S.* Jangwani clinical symptoms were more pronounced than usual *Salmonella* infections, including cases of abortions and fever in heifers. Clinical signs were not observed and *Salmonella* was not isolated in any adult cattle.
In one of the *S.* Dublin infected herds a positive bulk milk sample was obtained one month after release of restrictions. Faecal samples from all animals were examined for *Salmonella* twice with one month interval with negative result. Despite this event the herd was considered to be infected with *Salmonella* once during 2000.
S. Typhimurium DT 104 was not isolated in cattle in 2000.

Sheep, goats and other food producing animals
The *Salmonella* situation in sheep, goats and other food producing animals during 2000 was also very favourable.

Sheep, goats
During 2000 one *Salmonella* infected sheep herd was notified, *S.*Subspec IIIb (61:-:1,5). The infection was detected by faecal sampling (table 3.2.4.). No cases were found in goats.

Horses
A total of five cases of *Salmonella* were notified during 2000 (table 3.2.4.) *S.* Typhimurium DT 40 was isolated in 3 cases, DT 41 in one case and *S.* Düsseldorf in one case.
In March, *S.* Typhimurium DT40 was isolated in two horses artificially infected in an experimental trial with *Clostridium* spp. at a large animal clinic. The horses developed fever and faecal culture revealed *Salmonella*. The horses were euthanised.

At the same clinic, in July, *S.* Typhimurium DT40 was isolated from a horse that developed clinical symptoms after surgery and died. Trace back investigations identified two infected herds. However one of these was infected with an other sero type, *S.* Düsseldorf. One case *S.* Typhimurium DT 41 was identified at autopsy of a foal. Investigation in the herd of origin revealed four additional infected foals. All adult horses were negative.
S. Typhimurium DT104 has not been isolated in horses in 2000.

Other
During 2000 a total of 16 *Salmonella* infected cats were reported, the majority (n=10) were infected with *S.* Typhimurium DT 40, the strain isolated in wild passerine birds. Three cats were infected with *S.* Typhimurium NST. All these 3 NST strains had the same phage type pattern as the NST strains isolated in cats and wild passerine birds during 1999 (identified as S. Typhimurium U277 by Collindale). In two cases *S.* Typhimurium DT104 was isolated. These cases were associated with an outbreak of 24 human cases of DT104. One of the strains was resistant to seven of the tested antimicrobials (see Antibiotic resistance in *Salmonella* from animals). In one case *S.* Düsseldorf was isolated.

Salmonella was isolated from 2 dogs. In one case both *S.* Senftenberg and *S.* Infantis was isolated and in the other *S.* Virchow.

Twenty five isolates from reptiles were also reported, sero and phage types are detailed below;

S. Uzaramo (2)
S. Chicago (2)
S. Enteritidis fage type 8
S. Florida (3)
S. Halle (2)
S. Havana
S. lome.
S. Muenchen (3)
S. Newport (2)
S. Rubislaw
S. Saint-paul
S. subspecies II : 42:z:26 (2)
S. subspecies II = 58:1z13,z28:z6
S. subspecies IIIa = 41:Zy,Z23:-
S. subspecies IIIb = 16:Z10:enxZ15
S. subspecies IIIb: 053:Z10:Z.

Wildlife
S. Typhimurium was isolated from 5 passerine birds, 4 cases were due to phage type DT40 and one case due to phage type NST (identified as S. Typhimurium U277 by Collindale).

Antibiotic resistance in Salmonella from animals

In Sweden active surveillance of antimicrobial susceptibility among *Salmonella* of animal origin has been performed regularly since 1978. The surveillance includes isolates from all notified cases of *Salmonella* from warm-blooded animals. Any finding of *Salmonella* in animals is notifiable and the isolate has to be sent to the national reference laboratory for confirmation and antibiotic resistance testing. If several animals in the same epidemiological unit are infected, only the first isolate is sent for confirmation.

Susceptibility is tested with a microdilution method (VetMIC™) following the recommendations of National Committee of Clinical Laboratory Standards (NCCLS) (Table 3.2.6).

In 2000, a total of 67 isolates were investigated. Of these, 46 were *S.*

Typhimurium, three *S.* Dublin, one *S.* Enteritidis and the remainder, 18 isolates, were other serovars. Of the *S.* Typhimurium isolates only 7% were from cattle, and as much as 37% originated from pets and horses.
Results are given in Tables 3.2.5.1 and 3.2.5.2. Overall only five isolates (8%) were classified as resistant to any of the antimicrobials tested. Of these isolates four were *S.* Typhimurium and one was *S.* Yoruba. The *S.* Yoruba isolate was resistant to sulfamethoxazole alone. Of the four *S.* Typhimurium isolates three were resistant to only one antimicrobial (nalidixic acid or streptomycin). The fourth *S.* Typhimurium isolate however was resistant to seven of the tested antimicrobials (amoxicillin/clavulanic acid, ampicillin, chloramphenicol, florfenicol, streptomycin, sulfamethoxazole and oxitetracycline). This isolate emanated from a cat and was *S.* Typhimurium DT 104 (see " Results of investigations 2000 in other animals").

More information on antibiotic resistance in *Salmonella* and other bacteria of animal origin can be found in the report SVARM 2000 (Swedish Veterinary Resistance Monitoring) that is available at http://www.sva.se/.

Salmonella in food

Surveillance/notification systems

Any finding of *Salmonella* in food of animal origin, irrespective of subspecies, is notifiable, whether it is in official control, or the self-control of establishments. In official control findings of *Salmonella* in all kinds of foods are notifiable.
Sampling strategies at cutting plants are outlined in the Swedish salmonella control programme approved by the EU. The frequency of sampling is correlated to the capacity of the establishment. Depending on the production capacity, sampling is performed daily, weekly, monthly or twice annually. Samples consist of crushed meat, trimmings etc.

Methods used

NMKL method No. 71 is used. Sometimes, if results are questioned, or in cases of export or import analysis, a modified ISO 6579:1993 is used, in which the selenite broth enrichment is excluded.

Measures taken in case of salmonella isolation

Any food contaminated with *Salmonella sp.* is deemed unfit for human consumption and destroyed.
If *Salmonella* of any subspecies is isolated in food of animal origin, the origin of contamination is traced back to the contaminated carcass, as well as slaughterhouse or holding whenever possible. Effective cleaning and disinfection of the premises and equipment is immediately carried out in the plant. Increased sampling is also performed to verify that the *Salmonella* contamination is eliminated. If *Salmonella* is found in foods of vegetable or other origin the same procedure is used – the source of infection is identified, effective cleaning and disinfection of the premises and equipment is immediately carried out, the remainder of the consignment is traced, and destroyed if found.
Consignments originating from EU countries, found contaminated with *Salmonella* (at spot checks) are traced back if possible and destroyed or returned to the sender in accordance with art 7.2 of Directive 89/662/EEC. Consignments from third countries are not allowed to enter Sweden if *Salmonella* of any subspecies is found at border inspection points. Fresh meat, meat preparations and minced meat from non-EU countries are always checked for *Salmonella*.

Results of the investigations in 2000
(Table 3.3.1-3.3.3.)

Sampling at cutting plants

In all, 5 528 samples (4 454 from beef/pork and 1 074 from poultry) were collected from cutting plants supervised by NFA (figures 1.13 and 1.14). In addition 2 047 samples were collected at cutting plants supervised by local municipalities. One positive sample (*S.* Typhimurium DT104) was isolated from a cutting plant, supervised by the NFA, handling beef/pork. The source of origin was not determined, but contamination by imported meat can not be excluded as contamination of the cutting plant with *S.* Typhimurium of other serotypes (DT193, and NST) originating from imported pork occurred at the same time.
One positive sample (*S.* Typhimurium 1,4,12:i:1,2) was also found in a cutting plant supervised by local authorities. The source of infection was likely to be imported meat.
At slaughterhouses, 3882 neck skin samples were from poultry, mainly from broilers, but also from layers and other poultry. All samples were negative (figure 1.12).

Official control performed by municipalities

During 2000, 127 out of the 289 local municipalities have reported results from their official control. In all, these municipalities analysed 9 539 samples and 3 were positive for *Salmonella* (Table 3.3.1. and 3.3.2.). One of those samples was a *S* Typhimurium DT 104 found at a restaurant, in a raw hamburger of unknown origin).

Salmonella project 2000

During the fall of 2000, a *Salmonella* project was conducted by one of the largest municipalities in Sweden. The aim of the project was to find out more about *Salmonella* in new exotic types of food. The imports from third countries are steadily increasing, and there have been cases of disease caused by *Salmonella* in such spices and vegetables (*S.* Cerro and St paul). There is no control of *Salmonella* in such products at the border inspection points. Sampling was performed at 12 different retailers and wholesale dealers selling fresh oriental spices and vegetables, and analyses for *Salmonella* performed in 60 single samples of various origins collected in those establishments. Of those 10 % (6 samples) were positive for *Salmonella* of different subspecies: *S.* Weltevreden (3 samples), *S.* Newport*, S.* Mbandanaka*,* and *S.* subspecies *III.* All of them were different leafy spices from Thailand: coriander, Cha ploo, Phak kan jaeng, Panda Rivis-leaves, Pak Praw-leaves and Dok Sa No (Table 3.3.2.).

Spot-checks of consignments originating from EU

A total number of 39 consignments were reported to be contaminated with *Salmonella* when spot checks were performed on fresh meat originating from various EU-countries (33 consignments) and meat sold to Sweden from various EU-countries but originating in third countries (6 consignments). (Table 3.3.3). That dispatching EU-country is then responsible for the *Salmonella* testing according to the Swedish *Salmonella* Guarantees. Six of the 39 consignments were contaminated with more than one kind of *Salmonella*, one with as many as 4 different serotypes.

Meats arriving directly from third countries are always controlled at the Border Inspection Points (BIP), and there any consignment with a positive findings will be rejected and not allowed to enter Sweden. In such BIP checks 9 different consignments were found to be *Salmonella* contaminated during the year 2000, meat as well as shellfish and food of vegetable origin. One consignment of pork meat was found positive for five different serotypes of *Salmonella* and the others were infected with one serotype each.
All kinds of meat, as well as other types of foods, may also be controlled for *Salmonella* in various random municipal official inspections.

Salmonella in humans

Surveillance/ notification systems

Salmonella infection is a notifiable disease under the Communicable Diseases Act. The surveillance is mainly based on passive case findings. In addition sampling of contact persons, occur in connection with *Salmonella* cases/outbreaks. People in certain "risk professions" may be voluntary sampled after visits abroad. Figures in this report are based on reports by physicians[6].

Case definition

A case is defined as a person from whom *Salmonella* of any sero type has been isolated. Thereby subclinically infected persons are also included in the number of cases. An investigation is performed on all cases of salmonellosis. A case is considered to be of domestic origin if the person is 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 *Salmonella*.

Epidemiological history

The total number of reported cases[7] during the last twenty one years (1980-2000) has ranged between 3562 and 5534 (figure 1.5.). Approximately 85% of the cases were infected abroad.
The number of domestic cases has ranged between 452 and 1215 during these ten years (the annual incidence range is approximately 5-14/100 000).

Results of the investigations in 2000 (Table 3.4.1 and 3.4.2)

During 2000, totally 4845 cases were reported, 4617 reports from the physicians and 4800 laboratory reports.
Of the 4617 cases reported by physicians, approximately 85 % were infected abroad. In all, 691 domestic cases (incidence 7.8/100 000) were reported along with 20 cases with unknown country of infection. The number of domestic infections has decreased compared with 1999 when 903 domestic cases were reported. The reason for this decrease is due to the absence of any large outbreaks during 2000.
During 2000 11 minor food borne outbreaks have been reported:

- At a new years party, five persons contracted *S.* subspecies I.
- At least 18 persons in one area contracted *S.* Typhimurium DT 104. Despite close investigation no source of infection could not be identified.
- Four persons were infected with *S.* Enteritidis NST after a common dinner.
- At a buffet dinner ten persons contracted *S.* Enteritidis NST
- In the very south of Sweden, 24 persons contracted *S.* Typhimurium DT 104 during a short period of time. No source of infection was identified. In two families (four cases together) a cat was also found infected.
- 10 people contracted *S.* Bredeny at a meal at a restaurant.
- Three persons contracted *S.* Enteritidis NST at a dinner with barbecued loin of pork, potato salad and lettuce.
- 22 persons contracted *S.* Typhimurium DT 40 at a common dinner. The probable source of infection was home grown spices at a day care centre used at the common dinner.
- 11 persons were infected with *S.* Typhimurium DT 204 during the autumn. The source of infection was unknown.
- Ten persons with connection to a hospital contracted *S.* Mikawasima.
- Imported ready made mix of salad, among other products containing bean sprouts caused infection with *S.* Enteritidis PT 4b in 11 persons. At the same time a *Salmonella* outbreak of the

[6] See introduction
[7] Reports by physicians

same sero- and phage type occurred in the exporting country.

S. Typhimurium is the most common domestic serotype reported followed by *S.* Enteritidis, *S.* Agona and *S.* Stanley (see table 3.4.2.). Among the phage types of S. Typhimurium DT 104, is the most frequent with 88 reported cases and DT 40 with 24 cases. Among *S.* Enteritidis phage type 4 dominate with 43 cases.

Relevance as zoonotic disease

Since many years approximately only 10-15% of all notified cases have been domestically acquired. Sources of domestic human infections vary.
As Swedish red and white meat and eggs are virtually free from *Salmonella*, the risk of contracting salmonellosis in Sweden is small compared to many other countries. The low annual incidence of domestic cases supports this statement.

TRICHINELLA SPIRALIS/NATIVA/BRITOVI

Trichinella in animals

Disease agent

Trichinella spiralis, Trichinella nativa and *Trichinella britovi*

Surveillance/notification systems

Trichinosis is compulsory notifiable. All slaughtered pigs (including wild boars), horses and bears are investigated for the presence of *Trichinella* (see table 4.1.).

Methods used

The magnetic stirred method for pooled samples is mainly used. When investigating samples from horses, 5g of diaphragm muscle or, in some few cases, *Musculus masseter* is analysed by the magnetic stirred method.

Case definition used and epidemiological unit

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

Measures taken if trichinosis is diagnosed

The carcass of an infected animal will be destroyed.

Epidemiological history

The main reservoir for *Trichinella* spp. in Sweden is the red fox (*Vulpes vulpes*). Approximately 10% of the fox population is estimated to be infected. All three species of *Trichinella*, i.e. *spiralis, nativa* and *britovi*, have been found in red foxes in Sweden.
In the early 1980'ies 8-10 cases were reported annually. The source of infection has usually been unknown, but rodents have been suspected. After 1986, the number of reported cases decreased and after 1995 no cases have been reported in domestic pigs. However, in 1997, 1998 and 1999 sporadic cases (<3 per year) have been reported in wild boars (free living or farmed wild boars or crossbred wild boar/domestic boar).

Results of the investigations in 2000 (Table 4.1)

During 2000, no cases were notified in domestic pigs or wild boars. One case of trichinosis was reported in a fox.

Trichinella in humans

Surveillance/ notification systems

Trichinosis is a notifiable disease under the Communicable Diseases Act. The figures of trichinosis in this report are based on reports by physicians [8].

[8] See introduction

Case definition

A case is defined as a person in whom trichinosis has been verified by laboratory investigations (histopathology or serology). Cases with typical clinical symptoms could also be reported.

Epidemiological history

During the last ten years no cases of trichinosis in humans have been reported from Swedish laboratories. However, one clinical case was reported in 1991, according to the clinical report that person had contracted the disease abroad after eating pork.

Results of the investigations in 2000 *(Table 4.2)*

No case of trichinosis has been reported.

Relevance as zoonotic disease

The risk of obtaining trichinosis from domestic sources is negligible.

RABIES

Rabies in animals

Surveillance/notification systems

Rabies is notifiable already on clinical suspicion in Sweden. Apart from this, there is no official surveillance system for rabies in animals, except the ordinary clinical surveillance performed by veterinarians. In addition, hunters are advised to notify the authorities of any animals they find which behave in such a way that rabies might be suspected.

Laboratory test for diagnosis

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 not allowed in Sweden except for dogs and cats going abroad.

Measures taken in case of rabies diagnosis

Should rabies occur, relevant measures to eradicate the disease would be taken.

Epidemiological history

No case of rabies has occurred since 1886 and Sweden is recognised as free from rabies. All dogs and cats entering the country (excluding animals originating from rabies free countries and EU and EFTA countries) have to be kept in quarantine for 4 months. Dogs and cats from EU and EFTA countries can enter the country after rabies vaccination and antibody titre control according to Swedish requirements.
In 1987-89 and 1999 surveys were performed where sick or dead bats (n=200 and 75 respectively) were investigated for rabies, all were negative.

Results of the investigations in 2000

No cases of rabies occurred in animals in Sweden in 1999. Nine dogs, nine cats, 11 bats and three other animals were investigated. All samples were negative for rabies.

Rabies in humans

Epidemiological history

Rabies is a notifiable disease under the Communicable Diseases Act. Until this year no case of rabies had occurred since 1975 when a person contracted rabies after taking care of a puppy in India.

Results of the investigations in 2000

A young woman contracted rabies after a visit to Thailand. She had taken care of a wounded puppy, which later died. The dog had been licking the woman.

Relevance as zoonotic disease

As Sweden has been free from rabies in animals since 1886 and has strict import regulations, there is no domestic rabies threat to humans.

CAMPYLOBACTER (thermophilic)

Campylobacter in animals

Disease agent

Campylobacter jejuni and *Campylobacter coli.*

Surveillance/notification systems

Infection with *Campylobacter* is not compulsory notifiable in animals. A surveillance system exists only for broilers. It is an industry led programme where every flock sent for slaughter, is examined for *Campylobacter* at the slaughterhouse.

Methods used

Cloacal swabs from 10 broilers per flock are collected and pooled, and samples are sent to one laboratory and analysed for the presence of *Campylobacter* spp. by routine diagnostic methods. Species identification, such as serotyping or other subtyping methods are not routinely performed.

Case definition used and epidemiological unit

A case is defined as any sample from a sampled flock, being positive for *C. coli* or *C. jejuni*. The epidemiological unit is the slaughtered flock.
In animals a case is defined as an animal from which thermophilic *Campylobacter* spp. has been isolated.

Measures taken in case of campylobacter isolation

The intention is that if a flock is positive for *Campylobacter*, the flock owners should introduce more stringent hygiene measures at the farm level in order to exclude *Campylobacter* from broiler houses. If *Campylobacter* is not found at the control at slaughter, the farmer gets better paid for the broilers from some companies.

Epidemiological history

The industry led programme, in combination with the basic requirements of the salmonella control programme, have reduced the prevalence rates of *Campylobacter* positive broiler flocks to less than 10% in the last years. The prevalence varies between farms and some farms seem to be totally free. More than 50% of farms are free from *Campylobacter* all year round and the majority of those have been free for several years. A seasonal variation is observed (figure 2.1) Based on a limited study, the distribution of strains between *C. jejuni* and *C. coli* has been estimated to be approximately 98% and 2% respectively.
The lower incidence in flocks should reduce the overall level of contamination of carcasses and thereby the risk for the consumer handling raw chickens in the kitchen.
However, in previous years the incidence of domestically acquired campylobacteriosis has not appeared to be correlated to the prevalence in broilers. The reason for this discrepancy is not clear. Although the Swedish consumption of broiler meat has increased by 100% during the last 10-15 years, it is probable that other important sources of infection exists.

Results of the investigations in 2000 *(Table 6.1)*

During 2000, 3 969 flocks, with in total 67 million broilers (98% of all broilers slaughtered during 2000 in Sweden) were tested. In all, 392 flocks were found to be positive, representing 9.9% of all flocks slaughtered that year. The prevalence of positive flocks during 1992-2000 is illustrated in figure 2. As species

identification is no longer performed, the distribution of strains between *C. jejuni* and *C. coli* is not known, but there is no reason to believe that the situation has changed since previous years (see ”epidemiological history”).
The seasonal variation in the finding of *Campylobacter* spp. in broiler flocks is illustrated in figure 2.1.

Campylobacter in food

Surveillance systems

There is no officially co-ordinated surveillance system for *Campylobacter* in food. Surveillance is achieved by various projects initiated by municipalities, the National Food Administration, the Institute for Meat Research and other research institutions.

Methods used

The NMKL 119:1990 2:nd ed. is used.

Measures taken in case of campylobacter isolation

No measures are taken in case of positive findings. Should an outbreak occur, the National Food Administration decides what action to take.

Results of the investigations in 2000 *(Table 6.2)*

Samples collected by the local municipalities in official control.
In 2000 NFA and the local health authorities ran a nationwide project to study the presence of thermophilic *Campylobacter* in different raw meats. Altogether 4463 samples were analysed. The results are presented in table 6.2. As can be expected *Campylobacter* was most commonly found in poultry, where 9% of raw poultry meat were contaminated with campylobacters.

In addition, other sampling performed within the official control have been summarized for 127 out of the 289 local communities. A total of 357 samples were collected (Table 6.2.) and all were negative.

Campylobacter in humans

Surveillance/ notification systems

Campylobacter infection is notifiable under the Communicable Diseases Act. The surveillance is mainly based on passive case findings. Figures in this report is based on reports by physicians[9].

Case definition

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

Epidemiological history

Infection with *Campylobacter* became notifiable in 1989. In the last ten years the total number of reported *Campylobacter* infections[10] have fluctuating between 4275 – 7646 and the domestic cases 1383 – 2574 figure 2.2. The reason for the year-to-year variation is unknown.

Results of the investigations in 2000 *(Tables 6.3.)*

During 2000, totally 8405 cases were reported, 7646 reported by physicians and 8245 by laboratories. This is the largest figure ever reported.
Of the 7646 cases reported by physicians, where information concerning place of infection was available, 2443 cases were of domestic origin (incidence 27.5/100 000). The domestic cases constituted 32 % of all reported cases (Fig 2.2.). An increase of the domestic cases with 235 cases was observed compared to 1999. No larger outbreaks or other epidemiological information can explain this increase. In addition, 159 cases with unknown country of infection was also reported.

[9] See introduction
[10] Reports by physicians

In all, totally 8405 cases were reported, The increased number of imported cases during the last years is mainly due to a rise of the number of cases from Asia and could be explained by the increased travelling to this area.

Most reported cases are sporadic. Five domestic outbreaks, including 75 cases, were reported in 2000. The major part was due to three waterborne outbreaks including 69 infected persons.

Campylobacter outbreaks

- A sewage tank over flowed and polluted the water source, an open spring, 22 persons got infected.
- An open spring was contaminated during heavy rains and five persons contracted C*ampylobacter*.
- Drinking of surface water collected in the forest, resulted in 42 soldiers (during a military exercise) contracting C*ampylobacter*.
- Unpasteurised milk caused C*ampylobacter* infections in two siblings.
- Unpasteurised milk caused C*ampylobacter* infections in four persons.

Relevance as zoonotic disease

Campylobacteriosis is the most common bacteria causing infectious diarrhoea in Sweden today. A significant part of the reported cases (30-45 %) is of domestic origin. The population etiological fractions are unknown and more knowledge is needed concerning the epidemiology of the disease to be able to decrease the number of human cases.

LISTERIA MONOCYTOGENES

Listeria in animals

Disease agent

Listeria monocytogenes

Surveillance/ notification systems

There is no specific surveillance system for listeriosis in animals, surveillance is based on clinical observations. Listeriosis is notifiable in all animals.

Methods used

Histopathology, immunohistochemical methods and bacteriology.

Case definition used and epidemiological unit

A positive histopathological diagnosis in combination with clinical signs of listeriosis is defined as a case. A positive bacteriological result has to be combined with a positive histopathological diagnosis to be defined as a case. A positive immunohistochemical result in combination with histological lesions is defined as a case. The animal is the epidemiological unit.

Measures taken if L. monocytogenes is isolated

In a verified case of listeriosis, the SBA decides on a case by case basis, to investigate the herd and try to clarify the source of infection. When appropriate, the veterinary investigation is carried out in co-operation with local public health authorities. The veterinarian is also obliged to inform the owner of the zoonotic aspects of the disease and prophylactic measures will be recommended in order to avoid recurrence of the disease.

Epidemiological history

The situation has been stable over the years with approximately 10-20 cases annually. However in 1999, an increase in reported cases occurred (46 notified cases). The reason for this increase is not known.

Results of the investigations in 2000

During 2000, the number of notified cases decreased compared to 1999. In all, 34 cases were notified. Twenty one cases of listeriosis were notified in sheep, five cases

in cattle and eight cases in other species.

Listeria in food

Surveillance/notification systems

There is no officially co-ordinated surveillance system for *Listeria monocytogenes* in food. Surveillance is achieved by various projects initiated by municipalities, the National Food Administration, the Institute for Meat Research and other research institutions.

Methods used

An in-house (NFA) method is used for quantitative analysis and NMKL 136 for qualitative analysis.

Measures taken if L. monocytogenes is isolated

Listeria monocytogenes found in food supposed not to be further heat-treated: If the number of bacteria exceeds the cut-off point (if in one sample of five, more than 100 colonies/g or in two or more of five samples 10 or more colonies/g are found) the food will be classified as not fit for human consumption and subsequently destroyed.

Results of the investigations in 2000 *(Table 7.1)*

Samples collected by NFA
795 environmental samples were taken in different food producing plants (meat products and ready-to-eat foods). Of these 29 (3,7%) were positive.

Samples collected by the local municipalities in official control:
A total of 385 samples from different kinds of food have been analysed. Of these 18 (5%) were positive. In fish products 6 of 35 samples were positive which should be compared with 2 positive samples of 113 analysed in fresh and frozen fish. These findings support the suspicion that environmental contamination is of great importance in the fish plants.
Also of interest is that 8 of 82 samples of ready-to-eat foods were positive.
There is at present no information linking any special food items to the observed increase in incidence in human listeriosis. However, in 2001 NFA and the local municipalities will perform a joint project studying the prevalence of *Listeria monocytogenes*in different kinds of ready-to-eat-foods. It is hoped that the results will give a better understanding of the relation between *Listeria monocytogenes* in foods and human listeriosis

Listeria in humans

Surveillance/ notification systems

Listeriosis is a notifiable disease under the Communicable Diseases Act. The figures of listeriosis in this report are based on reports by phisicians[11].

Case definition

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

Epidemiological history

The situation has been stable, with approximately 25-35 cases[12] are reported annually. Normally, no reported cases are observed outside the vulnerable groups (immune-suppressed persons, pregnant women and elderly). Single cases not known to belong to any risk group may occur.

Results of the investigation in 2000 *(Table 7.2.)*

During 2000, totally 53 cases were reported, 46 reported by physicians and 48 by laboratories.
This is an increase compared to 1999, when 27 cases were reported by physicians

[11] See introduction
[12] Reports by physicians

(figure 3). The reason for this increase is unknown.
In 2000, a young women not known to belong to any risk group was infected. Infection during pregnancy occurred in two cases. Due to improved reporting system information concerning fatalities have improved in 2000 and totally 8 fatalities were reported (table 7.2). However, as reporting is not perfect, the true figure may be even higher.

Relevance as zoonotic disease

Foodborne transmission is believed to be more important than transmission from animals. As in other countries, Listeriosis has practically only been relevant as a zoonotic disease in immuno suppressed people and pregnant women.

YERSINIA ENTEROCOLITICA

Yersinia in animals

No specific surveillance systems exist for those *Yersinia* species considered as zoonotic agents. Yersiniosis is not notifiable in mammals.

Yersinia in food

Surveillance systems

There is no officially co-ordinated surveillance system for *Yersinia* spp. in food. Surveillance is achieved by various projects initiated by municipalities, the National Food Administration, the Institute for Meat Research and other research institutions."

Methods used

Bacteriological examination according to NMKL 117, 3rd ed, 1996 is performed. In addition a PCR, NMKL 163:1998, may also be used.

Measures taken if Yersinia enterocolitica is isolated

When products that will not be exposed to further heat treatment are positive for pathogenic serotypes of *Yersinia enterocolitica*, they will be classified as not fit for human consumption and subsequently be destroyed.

Results of the investigations in 2000

No investigations of *Yersinia enterocolitica* were reported in 2000.

Yersinia in humans

Surveillance/ notification systems

Yersiniosis is a notifiable disease under the Communicable Diseases Act. The figures of yersiniosis in this report are mainly based on reports by physicians[13].

Case definition

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

Epidemiological history

Prior to 1996, yersiniosis was only reported from laboratories. In the beginning of this decade more than 1000 cases of yersiniosis where reported compared to 600 in 2000[14]. This decrease could be due to improved hygienic technique during slaughter of swine and/or less sampling for Y*ersinia* spp. in patients.

Results of the investigations in 2000 (Table 8.3.)

During 2000, totally 632 cases were reported, 554 by physicians and 600 by laboratories.
In 554 cases information concerning place of infection was available. In 379 (68 %) of these cases the infection was considered to be of domestic origin and in 59 (11%) cases place of infection could not be

[13] See introduction
[14] Reports by laboratories

determined. The domestic incidence was 4.3/100 000 inhabitants.

Relevance as zoonotic disease

A significant part (approximately 70 %) of the human infections are of domestic origin. To be able to decrease the number of cases, more knowledge is needed concerning the epidemiology of the disease.

ECHINOCOCCUS GRANULOSUS/ MULTILOCULARIS

Echinococcus in animals

Disease agent

Echinococcus granulosus and *Echinococcus multilocularis*

Surveillance/notification systems

Echinococcosis is notifiable in Sweden. Inspection at slaughter is the only surveillance system in place.

Measures taken if echinococcosis is diagnosed

Offals from animals found infected with *Echinococcus* spp. will be destroyed. In order to prevent further cases, veterinarians at slaughter houses where reindeer are slaughtered have been recommended increased alertness, slaughter houses have been recommended not to sell uncooked offals and reindeer owners have been recommended to deworm their dogs.

Epidemiological history

Echinococcus multilocularis
This parasite has never been reported in Sweden.

Echinococcus granulosus
Sporadic cases occur in horses. Investigations have shown that they have been imported and probably were infected abroad.
In reindeer, *E. granulosus* was shown to be prevalent during the 70s. At slaughter, approximately 2% were infected. All cases occurred north of the polar circle. Based on these findings the routines at meat inspection of reindeer were revised and organs not approved for consumption had to be destroyed. During the ten years preceding 1996 no case of *E. granulosus* was found in reindeer. In 1996, 2 reindeer were found positive for *E. granulosus.* In 1997, *E. granulosus* was found in one reindeer but no case was found in 1998. In order to prevent *E. multilocularis* to be introduced into the country, imported dogs must be treated with praziquantel.

Results of the investigations in 2000 *(Table 9.1.)*

In 2000, *E. granulosus* was found at autopsy in two imported horses.

Echinococcus in humans

Surveillance/ notification systems

Echinococcosis is not a notifiable disease under the Communicable Disease Act. Figures in this report are based on reports by physicians[15].

Case definition used and epidemiological unit

A case is defined as a person where echinococcosis has been verified by laboratory investigations (histopathology or serology).

Epidemiological history

Notification of echinococcosis was initiated in 1994. Between 3 and 11 cases have been reported annually, all infected abroad.

[15] See introduction

Results of the investigations in 2000 *(Table 9.2)*

Three cases were reported during 2000. The foreign countries where they contracted the disease are unknown.

Relevance as zoonotic disease

Currently none of the echinococcus species represents any threat to humans in Sweden. However, due to the spread of the tape worm (*E. multilocularis*) in other European countries, including findings of the parasite in Denmark the situation might change in the future. Surveillance for this parasite was therefore initiated in 2000-2001 and roughly 200 foxes will be investigated for E. multilocularis.

TOXOPLASMA GONDII

Toxoplasma in animals

Disease agent

Toxoplasma gondii

Surveillance/notification systems

No specific surveillance system exists for toxoplasmosis in animals. Toxoplasmosis is not notifiable in animals.

Methods used

Isolation of the agent in mice or cell culture, immunohistochemistry or serology.

Case definition used and epidemiological unit

A case is defined as an animal that is positive in any of the above mentioned tests. The animal is the epidemiological unit.

Epidemiological history

Results of investigations performed during 1987 indicate that approximately 40 % of the cats, 23% of the dogs, 20% of the sheep and 1% of the horses in Sweden have antibodies against *Toxoplasma gondii*. Investigations performed in sheep showed that the prevalence increased with increasing age. A study in one herd showed that the incidence was higher on pasture than indoors.
Earlier investigations performed in pigs indicate that the prevalence before 1987 has been as high as 10%. A serological study performed on 807 slaughtered pigs in 1999 showed that 3.3% of fattening pigs (n=695) and 17.3% of adult pigs (n=110) were seropositive.
An investigation performed between 1991 and 1999 showed that 84 (38 %) of 221 red foxes had antibodies against *Toxoplasma gondii*.

Results of the investigations in 2000

Results of investigations are detailed in table 10.1.

Toxoplasma in humans

Surveillance/ notification systems

Toxoplasmosis is a notifiable disease under the Communicable Diseases Act. The figures of toxoplasmosis in this report are based on reports by physicians[16].

Case definition

A case is defined as a person where toxoplasmosis has been verified by laboratory examination (through isolation, PCR-technique or serology).

Epidemiological history

The true prevalence of toxoplasmosis is unknown. Concerning the number of reported cases, the situation is stable, in the last 10 years between 4 to 17 cases have been reported annually[17].

Results of the investigations in 2000 *(Table 10.2)*

During 2000, totally 26 cases were

[16] See introduction
[17] Reports by physicians

reported, 13 by physicians and 26 by laboratories.
Information concerning place of infection is only available in cases reported by physicians. In 8 (61 %) of the cases reported by physicians the infection was acquired in Sweden. This corresponds to a domestic incidence of 0.09/100 000 inhabitants. However, as information concerning place of infection is lacking for 50% of all reported cases and as most cases are subclinical and thereby not diagnosed the true domestic incidence is higher.

Relevance as zoonotic disease

Toxoplasmosis as a clinical disease is most important in immuno suppressed persons and in pregnant women. During pregnancy the infection can be transmitted to the foetus causing death or serious injury. However, more knowledge is needed concerning the most significant sources of infection in Sweden. The main source seems to be undercooked or raw meat.

VEROCYTOTOXIC E. COLI O157

VTEC O157 in animals

Disease agent

Verotoxin-producing *Escherichia coli* serotype O157

Surveillance / notification system

Since 1997, approximately 2000 faecal samples from cattle are collected annually at slaughter-houses and analysed for VTEC O157. If livestock contacts are reported in a human case of VT. *E. coli* O157 infection, the animals are investigated by bacteriological sampling. Any case of VTEC O157 with connection to a human case of enterohaemorrhagic disease is notifiable.

Methods used

VTEC O157
Isolation of VTEC O157 strains are made after pre-enrichment in buffered peptone water followed by immuno-magnetic separation (IMS; Dynal), and culture on sorbitol MacConkey with cefixime and tellurit (CT-SMAC). Suspected colonies are confirmed by latex agglutination and biochemistry. A PCR method is used to identify genes for VT production and eaeA genes. In addition, certain isolates have been subtyped PFGE. Case definition used and epidemiological unit

VTEC non O157
Enrichment is done in buffered peptone water in 37º C for 6 hours.Plating out from enrichment broth to McConkey agar. Incubation overnight in 37º C . From McConkey agarplate colony material is harvested for PCR analysis, analysis for VT1 and VT2. If a sample is positive for VT genes, individual colonies from the McConkey agarplate are picked and analysed individually for verotoxin production.

Case definition used and epidemiological unit

A case is defined as an animal from which VTEC O157 is isolated. The herd is the epidemiological unit. Case definition for notification see “surveillance/notification system”

Epidemiological history

VTEC O157 was first isolated in cattle in Sweden in 1996. In the same year, infection with *E. coli* O157 in humans in Sweden was for the first time traced to the presence of VTEC O157 in a cattle herd. Restrictions were laid on the herd and surveillance was initiated. Livestock was only allowed to leave the premises if transported directly to slaughter. In October 1996 findings of VTEC O157 became notifiable. Since summer 1999, only cases of VTEC O157 having a connection with a human case of EHEC is

notifiable.
Earlier slaughter house surveys have shown 0.8 % (4/474) of lambs and 0.9 % (1/109) of sheep and 0.08% (2/2446) of pigs to be positive for VTEC O157.
Routine slaughterhouse surveys on cattle since1997 have shown that between 0.3 and 1.7 % of faecal samples are positive for VTEC O157 (figure 4). The lower prevalence figures observed during 1998 – 1999 might reflect the smaller sample size analysed.
The number of cattle herds with suspected connection with human EHEC case and the number of herds where VTEC O157 have been identified in the herd(s) are detailed below:

Year	Number of cattle herds with suspected connection with human EHEC case	Herds where VTEC o 157 was isolated
1996	1	1
1997	8	4
1998	9	3
1999	6	3
2000	5+1*	0+1*

* Including one goat herd

Five of the herds were still considered infected with VTEC O157 at the end of 2000.

Results of the investigations in 2000 (Table 11.1)

In the annual slaughter house surveillance, 2003 faecal samples were taken from cattle. Sampling was proportional to the number of cattle slaughtered at each slaughter house. Of these, 34 samples (1.7%) were positive for VTEC O157. As seen in previous years the prevalence is higher in young animals compared to adult animals. In barley-beef calves (7-9 months at slaughter) 2 of 70 (2.9%) were positive, in young bulls (12-18 months at slaughter) 29 out of 1346 (2.2%) and in adult cattle 3 of 492 (0.6%) were positive.
A herd-level prevalence study was conducted during 2000. Twenty faecal samples were collected from cattle less than 1 year age from each of 123 dairy herds. The samples were pooled in groups of 5 (25 grams in each pooled sample). Nine (7%) the investigated herds were found infected with VTEC O157. The overall individual prevalence of VTEC *O 157* was calculated to 1-2 %. The prevalence was higher in the autumn compared to the spring, however, the difference was not statistically significant. As in previous years, no positive samples were obtained from the northern part of Sweden indicating a lower prevalence in this region.
In recently weaned calves (destined to meat production) a prevalence study was performed from January to May 2000. 600 calves originating from milk producing herds were sampled when transported to beef herds. Five gram of faeces from each of five calves was analysed in a pooled sample (25 grams). A total of 120 pooled samples were analysed and one pooled sample was positive, indicating an individual prevalence of 0.2%.
One goat herd was investigated to clarify if it could be the source of infection for a girl developing EHEC. The girl had eaten unpasteurised cheese made of goat milk from a local farm (see results of investigations in humans). One sample from a cheese originating from the farm was cultured for VTEC O157 with negative result. However it was not the same cheese that was consumed by the girl. Faecal samples from 19 goats and milk samples from 13 goats were cultured for VTEC O157. All milk samples were negative but 2 faeces samples were positive. Subtyping (PFGE) showed no difference between the goat isolates and the isolate from the girl. This specific PFGE-type had not been observed in Swedish animals or humans before.

Measures taken in infected herds with connection to clinical cases of EHEC in human

The authorities have established guidelines for the handling of infected herds with connection to cases of human disease. Any infected herd with connection to human disease will receive these recommendations. In short, the guidelines are as follows:

Movement of live animals from the herd of origin requires that each animal, prior to movement has tested negative for VTEC O157. In the herd, samples are taken four times a year for bacteriological examination and hygiene recommendations and other measures are instituted. Animals sent to slaughter are examined for VTEC O157. The recommendations are fore seen to be revised in 2001.
Concerning measures taken for contaminated carcasses, see ”*E. coli* O157 in food”.
The herd is considered to be free from the infection when faecal samples from all animals in the epidemiological unit (usually the herd) taken on two consecutive sampling with one month interval are negative.

VTEC O157 in food

Surveillance systems

There is no routine surveillance system for VTEC O157 in food in Sweden. See ”zoonotic agents in food”. On a voluntary basis, bacteriological examination for VTEC O157 is performed on slaughtered cattle and sheep originating from infected herds.
By the 1st January 1998, it was decided that 900 carcasses of cattle would be sampled annually. All large-scale slaughterhouses in Sweden are involved.

Methods used

Isolation of *E. coli* O157 strains is made according to NMKL 164. A PCR method is used to identify genes for VT-production and *eae*A genes.

Measures in case of positive findings

If VTEC O157 is found in food, NFA will take necessary action to ensure that contaminated food will not reach the consumer. In the industry led surveillance programme the carcasses are not arrested pending bacteriological results.
When there is a clear epidemiological connection to human cases of EHEC caused by an infection with VTEC O157, it is recommended that the animals from that holding should be slaughtered last in the day. All carcasses should be swabbed for VTEC O157 and the carcasses retained pending results. In case of positive findings the carcasses will be destined for heat treated products. The premises should be thoroughly cleaned and disinfected after such slaughter.

Epidemiological history

Until 1999 VTEC O157 had not been identified in food in Sweden. One positive sample was found in imported meat in 1996.

Results of investigations in 2000 (table 11.2)

In the voluntary slaughterhouse monitoring at 21 slaughter houses, performed by the industry one of the 968 (0.1%) examined beef carcasses was contaminated with VTEC *E. coli* O157 (figure 4.1.).
Unpasteurised goat cheese was suspected but not shown to be contaminated with VTEC O157 (see Results of investigation in animals). Sale of unpasteurised milk and milkproducts is only allowed from small farms and chalets with a small-scale production and under the condition that the products are sold at the site of production.

EHEC in humans

Surveillance/ notification systems

Since the first of January 1996, enterohaemorragic *E. coli* O157 is a notifiable disease under the Communicable Diseases Act. Any case where *E. coli* O157 has been isolated, including subclinically infected people is reported. HUS (haemorrhagic uremic syndrome) is not notifiable in Sweden. Other serotypes of verotocytotoxic E. coli than O157 is reportable on a voluntary bases. Figures of *E. coli* O157 in this report are based on reports by phycisians[18].

Case definition used

A case is defined as a person from whom *E. coli* O157 has been isolated.

Epidemiological history

During the autumn of 1995, and the first weeks of 1996, an *E. coli* O157 outbreak occurred in Sweden with about 120 confirmed cases. This increased the awareness of *E. coli* O157 and today most people with haemorrhagic diarrhoea will be investigated for the presence of this pathogen. Since 1996 between 59 and 138 cases[19].

Results of the investigations in 2000 *(Table 11.3.)*

During 2000, totally 97 cases were reported, 96 were reported by physicians and in one case only laboratory report was available. This is an increase with 37 cases compared to 1999. The increase was observed both in domestic and imported cases.
Sixty five (68 %) of the cases reported by physician were of domestic origin and 30 (31 %) were infected abroad. The domestic incidence was 0.73/100 000 inhabitants.
One case of HUS due to *E. coli* O157 and three cases of HUS due to non O157 (O121, O145 and O146) were reported. The true number of cases of HUS is unknown, as there is no mandatory reporting system for HUS in Sweden.
During 2000 two outbreaks occurred. In one case, a girl from the northern part of Sweden developed EHEC and her father and sister were subclinically infected with VTEC O157. The source of infection was probably unpasteurised cheese made of goat milk from a local farm (see results of investigations in animals. In the second outbreak, the infection was spread from person to person, mostly among young children. All together 11 persons contracted EHEC. The source of infection was unknown.

Relevance as zoonotic disease

VTEC O157 is an emerging zoonotic infection. It can not be excluded that large outbreaks may occur in the future. Compared with other food borne infections, infection with *VTEC* O157 could be very serious, especially in young children developing HUS. The epidemiology of the disease is not fully understood. Much research still has to be performed before it will be possible to determine whether an efficient strategy for controlling *VTEC* O157 can be implemented.
As a prophylactic measure, it has been recommended that young children (< 5 years of age) should not visit cattle farms and hygiene recommendations have been issued for other visitors.
Manure handling without risk of contaminating drinking water or products such as fruits or berries is a challenge.
A most research has focused on sero type O157 less is known about other sero types. Although it is known that other sero types causes a significant part of the EHEC cases in Sweden very little is known concerning the true occurrence of these sero types in animals, food and humans and their zoonotic impact.

[18] See introduction
[19] Reports by physicians