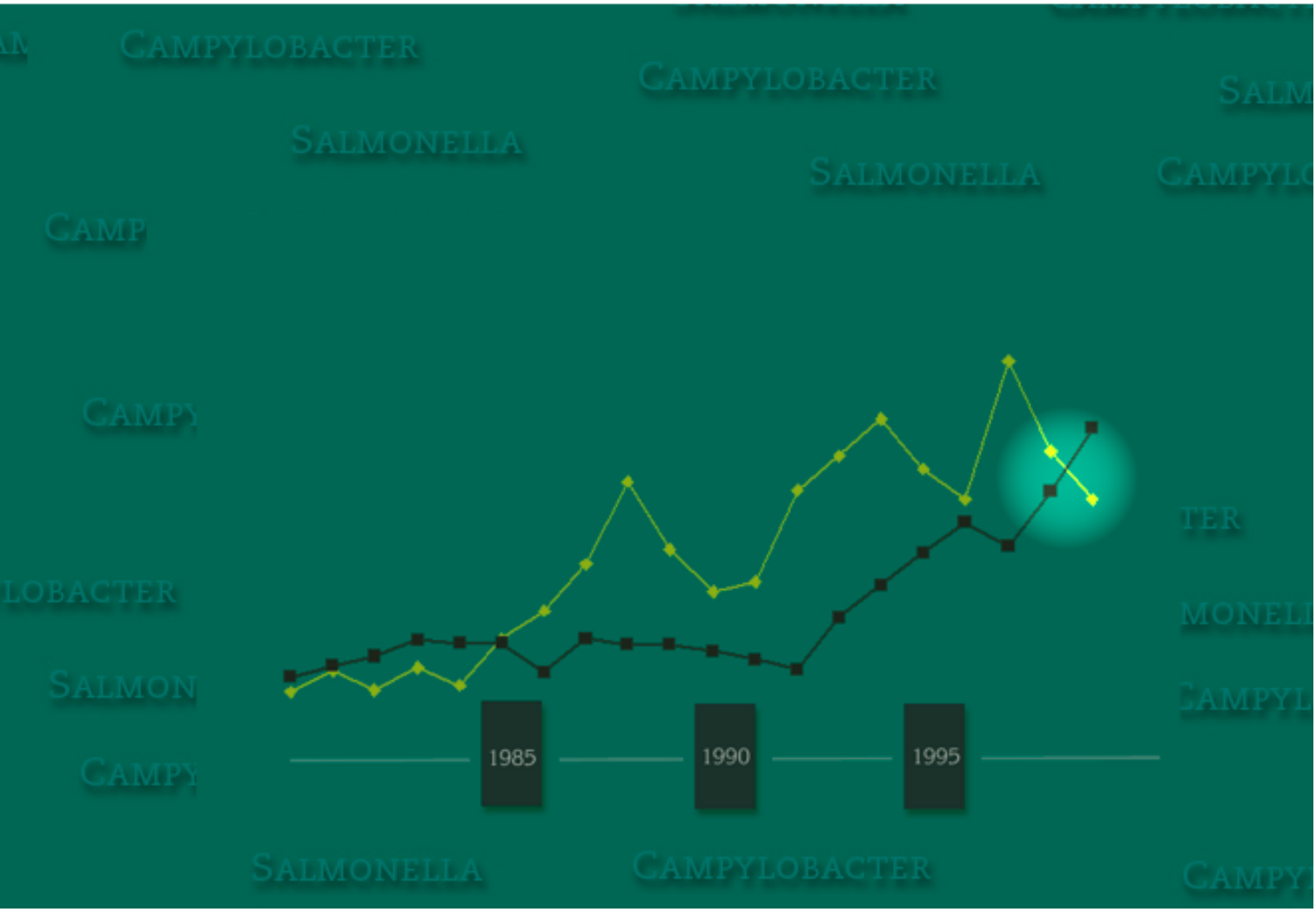
Annual Report on Zoonoses in Denmark 1999



Ministry of Food, Agriculture and Fisheries

Annual Report on Zoonoses in Denmark 1999

Ministry of Food, Agriculture and Fisheries, 2000.

Edited by:

Therese Brøndsted,
Danish Zoonosis Centre, Danish Veterinary Laboratory

Tine Hald,
Danish Zoonosis Centre, Danish Veterinary Laboratory

Birgitte Beck Jørgensen,
Danish Veterinary and Food Administration

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Reprints can be ordered from:
Danish Zoonosis Centre
Danish Veterinary Laboratory
Bülowsvej 27
DK - 1790 Copenhagen V,
Denmark
Phone: +45 35 30 01 48
Fax: +45 35 30 01 20
E-mail: sca@svs.dk
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The front page illustration: In 1999 the number of human infections with *Campylobacter* exceeded the number of *Salmonella*.

Contents

Introduction

In August 1997, the fourth revision of the Danish plan for implementation of the Zoonosis Directive (hereafter called "the Danish plan") was submitted to the EU Commission. The plan describes the details of the different national programmes for control of zoonoses in Denmark. Thus information about the origin of the data presented in this report can be found in the Danish plan.

Demographic data

Total number of livestock and herds in Denmark, 1999

	Livestock	Herds
Cattle	1,956,128	37,062
Pigs	7,359,196	23,387
Laying hens excl. barn yard sale	3,583,770	410
Broilers	36,313,268	342
Sheep	186,143	7,359

Source: The Central Husbandry Register

Approximate total number of animals slaughtered in 1999

Cattle: 580,000
Pigs: 20.1 million
Broilers: 137 million

Source: Danish Veterinary and Food Administration.

Human Population in 1999

Age group (years)	Population
<1	66,205
1-4	278,480
5-14	622,958
15-24	637,645
25-44	1,552,224
45-64	1,345,598
65+	790,467
Total	5,313,577

Area of Denmark:
44,000 sq km

1. Salmonella

Feeding stuffs

All Danish feed compounders are monitored for *Salmonella* by the Danish Plant Directorate. Monitoring includes sampling of compound feeds and feed materials, including raw materials of animal origin, and sampling during feed processing. Table 1 shows the overall results of the monitoring in 1999.

Samples of feeding stuffs

The Danish Plant Directorate collects samples of feeding stuffs from the production plants and retailers. The number of samples depends on the size of the production, but is increased if *Salmonella* is detected in the feeding stuffs or in samples taken during feed processing.

The number of *Salmonella* positive samples in compound feeding stuffs in 1999 is listed in Table 1. Compared to the previous years the good hygienic quality of compound feeding stuffs is stabilised at a very low level (Figure 1).

The occurrence of *Salmonella* in feed materials increased from 6.4% in 1998 to 14% in 1999 due to a screening of dog treats (dried pig ears and bull penises) where 37 (42.5%) of 87 samples were *Salmonella* positive. If the samples from this particular screening is excluded, the percentage of positive samples of feed materials reduces to approximately 6%.

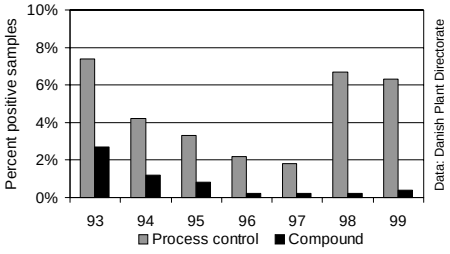

Figure 1. Percent Salmonella *positive samples of process control and compound feeds, 1993-1999.*

Samples from feed processing

Plant inspectors carry out the process control at least four times a year. Samples are collected for microbiological examination at the critical control points of the production process.

From compounders with heat treatment of the feeding stuff (more than 81°C), the samples are collected at critical control points after the heat treatment. When there is no heat treatment, the samples are collected during the entire process as well as from the feed materials.

The plants are inspected in order to check whether they comply with a national set of rules for good production hygiene. This includes control of the heat treatment, which is monitored every second hour during the process.

Additional inspections of the plants are implemented when *Salmonella* is detected in the samples or critical hygiene conditions are reported.

The occurrence of *Salmonella* positive samples from the process control at the plants decreased slightly from 6.7% in 1998 to 6.3% in 1999 (Figure 1).

Serotypes

The *Salmonella* serotypes found in feeding stuffs and at the inspection of the feed processing are listed in Table 1. The major parts of the *Salmonella* isolates belonged to exotic serotypes normally associated with feeding stuffs. All the samples of feed materials contaminated with *S.* Typhimurium - including two samples with *S.* Typhimurium DT 104 – were from the investigation of dog treats.

Summary

The results of the *Salmonella* control by the Danish Plant Directorate indicate that the good hygienic quality of compound feeding stuffs is stabilised. *Salmonella* was found only in a small percentage of the compound feeding stuffs samples.

However, the results of the inspection of the feed processing and the prevalence of *Salmonella* in feed materials show that *Salmonella* infected feed materials constitute a risk for the contamination of

Table 1. Control of Salmonella *in compound feeds, feed processing and feed materials in 1999.*

	Control of compound feeds				Process control	Feed materials
1999	Pig feed	Cattle feed 1)	Poultry feed	Others		
Total number of samples	1,385	648	269	155	3,306	385 (301 [2])
Salmonella detected	3	7	0	1	207	54 (17 [2])
Percent positive	0.2	1.1	-	0.6	6.3	14.0 (6.0% [2])
Serotypes	*S.* Lexington 2 *S.* Tennessee 1	*S.* Mbandaka 2 *S.* Derby 1 *S.* Lexington 1 *S.* Livingstone 1 *S.* Muenster 1 *S.* Tennesee 1	-	*S.* Cubana 1	*S.* Derby 64 *S.* Putten 30 *S.* Havana 24 *S.* Tennessee 15 *S.* Montevideo 11 *S.* Livingstone 6 *S.* Mbandaka 6 *S.* 4.12:-:- (afas.) 3 *S.* Infantis 3 *S.* Newport 3 *S.* 4.12:b:- 2 *S.* 4.12:b:-(monofas.) 2 *S.* Kentucky 2 *S.* Ohio 2 *S.* Rissen 2 *S.* Senftenberg 2 *S.* Typhimurium 2 *S.* 1.3.19:c:-(monofas.) 1 *S.* 4.12:d:- (monofas.) 1 *S.* 6.7:-:- (afas.) 1 *S.* 6.7:d: (monofas.) 1 *S.* 13.23:lw:- (monofas.) 1 *S.* Enteritidis 1 *S.* Eppendorf 1 *S.* Give var. 15+ 1 *S.* Idikan 1 *S.* Lexington 1 *S.* Muenster 1 *S.* Rissen/.*S.* Tennessee 1 *S.* Stanley 1 *S.* Urbana 1 *S.* Yoruba 1 *S.* spp. 13	*S.* Infantis 9 *S.* Derby 8 *S.* Typhimurium 8 *S.* Montevideo 6 *S.* Senftenberg 4 *S.* Putten 3 *S.* Enteritidis 2 *S.* 6.7:-:- (afas.) 2 *S.* 6.7:z10 (monofas.) 1 *S.* Agona 1 *S.* Derby/*S.* Typhimurium 1 *S.* Gaminana/*S.* Panama 1 *S.* Give 1 *S.* Havana 1 *S.* Livingstone 1 *S.* Mbandaka 1 *S.* Muenster 1 *S.* Panama 1 *S.* Tennessee 1 *S.* Worthington 1 *S.* spp. 1

Data: Danish Plant Directorate.

1) Includes feed for cattle, horses, sheep and rabbits.

2) Results of the monitoring of *Salmonella* in feed materials excluding the samples from the screening of dog treats.

the feeding stuffs plants. The results also make it clear that the hygienic standard on the plants can be further improved.

Rendering Plants

Control of hygiene at rendering plants is carried out by the animal health section of the Danish Veterinary and Food Administration. The products are monitored for *Salmonella*. In 1999, 87 pooled samples of the final products from rendering plants were examined for *Salmonella* - all with a negative result.

In 1999, 438 samples of fishmeal were examined and 4 (0.9%) were found to be contaminated with *Salmonella*. The serotypes found were *S.* Tennessee, *S.* Oranienburg, *S.* Agona and *S.* Livingstone.

Poultry and poultry products

In December 1996, the Danish Ministry of Agriculture and Fisheries implemented an extended surveillance and control programme for prevention of *Salmonella* in broiler- and table-egg production. This programme has been in force for 3 years at the end of 1999, but has been revised in the period. The strategy for the revised programme from 1998 was continued in 1999. Both parent flocks, rearing flocks and layer flocks were tested for all *Salmonella* serotypes. The number of establishments in the broiler and table-egg production and the frequency of testing is listed in Table 2 and Table 3, respectively

Flocks testing positive for *Salmonella* or *Salmonella* antibodies in the routinely collected samples (Table 3) were put under suspicion of infection with *Salmonella*. As a consequence, the district veterinary officer (DVO) collected additional samples. If the second set of samples were positive, the flock was declared infected with *Salmonella*. Breeder flocks and rearing infected with *Salmonella* were slaughtered. Eggs from layer flocks under suspicion and eggs from infected flocks were directed to heat treatment (pasteurisation). On farms with infected layer flocks, the examination of non-infected flocks was intensified. Eggs and faeces from such flocks were tested every 4th week instead of every 9th week.

No new flocks were permitted in the houses where infected flocks had been kept unless cleaning and disinfection was approved by the DVO.

In autumn 1999, the faecal samples collected in rearing and layer flocks changed to so-called “sock-samples” in floor production units. A sock-sample consists of 15 cm pieces of tube gauze mounted on the footwear

Table 2. Number of establishments in the broiler production and the table-egg production in 1999.

	No. of establishments	No. of houses	No. of animals
	Broiler production		
Central rearing	20	94	1,245,000 purchased per year
Broiler breeders	72	220	
Hatcheries	8	167 a)	
Broilers	358	826	144,500,000
	Table-egg production		
Central rearing	6	7	70 - 80,000 purchased per year
Layer breeders	11	20	
Hatcheries	6	55 a)	-
Rearing	126	200	3,739,000
Layers, except barn-yard sale	320	485	3,925,000

Data: Danish Veterinary and Food Administration.
a) Number of hatchers.

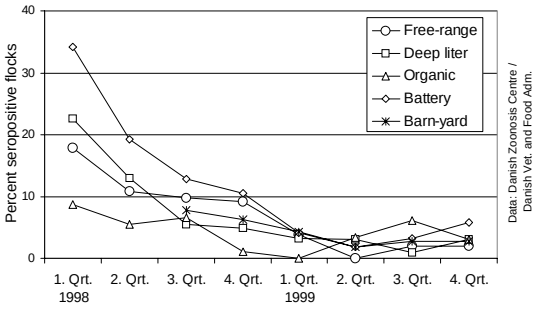

Figure 2. Number of flocks seropositive for Salmonella *according to type of table-egg production, 1999.*

Number of herds by type of production: Battery: 83; Deep litter: 129; Free range: 74; Organic: 113.
Source: The Central Husbandry Register.

Table 3. Salmonella *surveillance of the broiler and table-egg production,1999.*

Age or Frequency	Samples taken in 1999
	CENTRAL - REARING STATIONS Broiler and table-egg sector
Day-old chickens	10 samples of cratematerial, · 20 dead/destroyed chickens [a)]
1 week	40 dead chickens
2 weeks	20 dead chickens
4 weeks	30 dead chickens and 60 faecal samples [a)]
8 weeks	60 faecal samples
2 weeks prior to moving	12x5 faecal samples and 60 blood samples [a) b)]
	BREEDERS (HATCHING-EGG PRODUCTION) Broiler and table-egg sector
Every 2 weeks	50 dead chickens or meconium from 250 chickens taken from the hatchery [a) c)]
Every 4 weeks	60 faecal samples[s] and 60 samples of blood or eggs taken from the flock [d)]
	HATCHERY
Every week	Wet dust
	REARING - TABLE-EGG PRODUCTION
Day-old chickens	10 samples of cratematerial and 20 dead chickens
3 weeks	5x2 sock samples in floor production units or 60 faecal samples
12 weeks	5x2 sock samples in floor production units or 12x5 faecal samples, and 60 blood samples [b)]
	TABLE-EGG PRODUCTION
Every 9th week for eggs sold to authorized egg - packing centres	5x2 sock samples in floor production units or 60 faecal samples, and 60 egg samples
Every 6 months for eggs sold at barn-yard sale	Faecal and egg samples

Data: Danish Veterinary and Food Administration.
a) Requirements of the EU Zoonosis Directive (92/117/EEC).
b) Samples taken by the district veterinary officer.
c) Samples taken by the district veterinary officer every 8 weeks.
d) Samples taken by the district veterinary officer every 3 months.

during inspection of the house. This method has at least the same sensitivity as 60 faecal samples and the actual sampling is easier to perform.

Table-egg production

In 1999, no central rearing flocks were found infected with *Salmonella*. Among the layer breeders (hatching-egg production), 1 (3.8%) of 26 flocks was found infected with *Salmonella*. A total of 10 (2.4%) of 422 rearing flocks examined were found infected with *Salmonella* (Table 4). Of these, 5 flocks were infected with *S.* Enteritidis, 1 with *S.* Typhimurium and 4 flocks with other serotypes.

In flocks producing table eggs for authorised egg-packing centres, 37 (5.2%) flocks were infected with *Salmonella* out of 718 flocks examined (Table 4). Of these, 32 flocks were infected with *S.* Enteritidis and 2 flocks were infected with *S.* Typhimurium. Three flocks were found infected based on serological confirmation only. The sero- and phage-type distributions are shown in Table 15, 16 and 17.

In flocks producing table eggs for barn-yard sale, 12 (2.7%) of 449 examined flocks were confirmed as being infected with *Salmonella*. Of

Table 4. Occurrence of Salmonella *in the table-egg production in 1999.*

	Central rearing		Layer breeders		Rearing		Table-egg production	
	Examined flocks	Positive flocks (%)	Examined flocks	Positive flocks (%)	Examined flocks	Positive flocks (%)	Examined flocks	Positive flocks (%)
Salmonella spp.	14	0	26	1 (3.8)	422	10 (2.4)	718	37 [2)] (5.2)
S. Enteritidis	-	-	-	0	-	5 (1.2)	-	32 (4.5)
S. Typhimurium	-	-	-	0	-	1 (0.2)	-	2 (0.3)
Other serotypes	-	-	-	1[1)] (3.8)	-	4 (0.9)	-	0

Data: Danish Veterinary Laboratory and Danish Veterinary and Food Administration.
1) *S.* 4,5,12:i
2) Three flocks found infected based on serological confirmation only.

these, 10 flocks were found infected based on serological confirmation only.

The percentage of seropositive layer flocks (defined as flocks with two or more seropositive birds) by type of table-egg production is shown in Figure 2. At the beginning of 1998, a considerable difference between types of production was noticed: battery: 35%, deep litter: 23%, free-range: 18%, organic: 9%. However, this difference was not considered to be due to the production type, but rather depending on the hatchery, since many battery and deep litter producers were supplied by the same hatchery which had *Salmonella* problems. As a consequence of the control programme, the seroprevalence in all production types was reduced to less than 10% by the end of 1999.

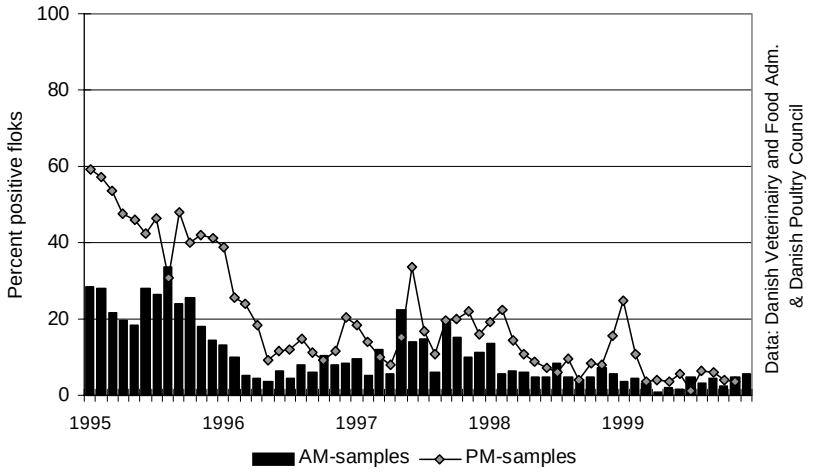

Figure 3. Percent Salmonell*a positive broiler flocks detected at the mandatory ante-mortem and post-mortem examination, 1995-99.*

Broiler production

In 1999, *Salmonella* was not isolated from any of 221 examined central-rearing flocks. Among the broiler breeders (hatching-egg production), 2 (0.6%) of 361 flocks were found infected with *Salmonella* (Table 5).

All broiler flocks were monitored for *Salmonella* by mandatory ante-mortem examination. Three weeks prior to slaughter, five pairs of sock-samples were collected from each flock. Herds producing less than 20,000 broilers for slaughter per year were excepted. The percentage of positive flocks ranged from 0.9% to 5.8% per month with a mean of 3.5% (Table 5, Figure 3). The most frequently encountered serotype was *S.* Typhimurium, which was found in 35.3% of the infected flocks. *S.* Enteritidis was isolated from 3.5% of the infected flocks. The sero- and phage-type distributions are shown in Table 15, 16 and 17.

Salmonella was detected in a total of 6.6% of the flocks after slaughter by examination of 5 pooled samples each consisting of 10 neck-skin samples from each slaughter flock (Table 5, Figure 3). This is a reduction compared to 11.1% in 1998.

Table 5. Occurrence of Salmonella *and* Campylobacter *in the broiler production in Denmark in 1999.*

	Flock level				Slaughterhouse		Retail - broilers and products of broiler meat				
	Broiler breeders		Broiler flocks		Neck skin		Not heat treated		Heat treated		
Zoonotic pathogen	Flocks examined	% positive flocks	Flocks examined	% positive flocks	N	% positive flocks	N	% positive samples	N	% positive samples	Note:
Salmonella spp.	361	0.6	4,716	3.5	5,117	6.6	262	8.0	411	0.4	a
S. Enteritidis	-	0	-	0.1	-	-	-	-	-	-	-
S. Typhimurium	-	0.6	-	1.3	-	-	-	-	-	-	-
Other serotypes	-	0	-	2.1	-	-	-	-	-	-	-
Campylobacter spp.	-	-	6,557	46.0	-	-	994	34	-	-	b
C. jejuni	-	-	-	40.4	-	-	-	-	-	-	-
C. coli	-	-	-	4.3	-	-	-	-	-	-	-
C. lari	-	-	-	0.1	-	-	-	-	-	-	-
Other species	-	-	-	1.2	-	-	-	-	-	-	-

Data: Danish Veterinary Laboratory and Danish Veterinary and Food Administration

a) Parent flocks were examined according to Table 3. Broiler flocks monitored by sock-samples 2-3 weeks prior to slaughter and by 50 neck-skin samples at slaughter.

b) Flocks investigated by cloacal swabs collected at slaughter, ten birds per flock were examined. Summed up in batches, where one flock is slaughtered in up to 6 batches.

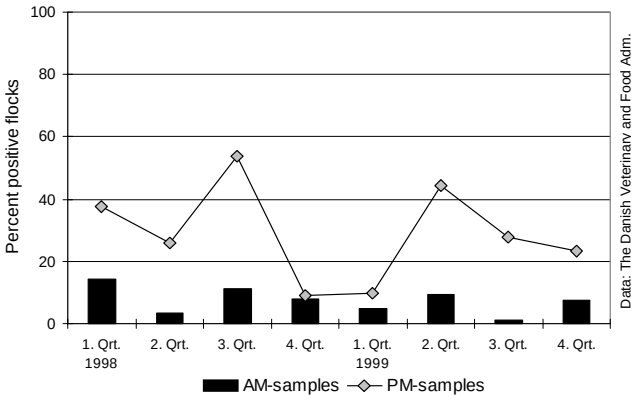

Figure 4. Percent Salmonella *positive turkey flocks detected at the ante-mortem and post-mortem examination, 1998-99.*

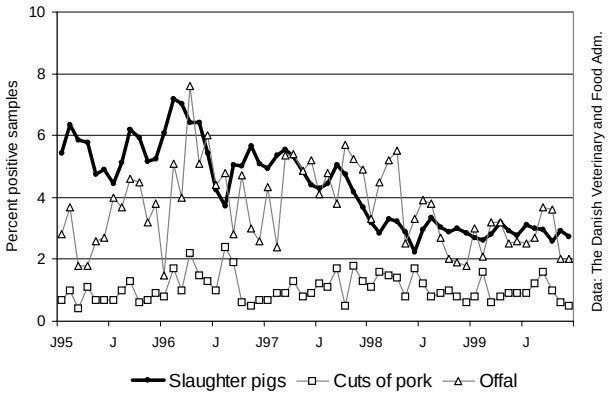

Figure 5. Percent seropositive meat-juice samples and percent Salmonella *positive samples of cuts of pork and offal, 1995-99.*

Turkey production

All turkey flocks were monitored for *Salmonella* by mandatory ante-mortem examination. Three weeks prior to slaughter, five pairs of sock-samples were collected from each flock. Herds producing less than 10,000 broilers for slaughter per year were excepted. In 1999, *Salmonella* was detected in 23 (6.3%) of 366 flocks investigated (Table 6, Figure 4). Of these, 10 flocks were infected with *S.* Derby, 8 flocks with *S.* Newport and 5 flocks with other serotypes. *S.* Typhimurium and *S.* Enteritidis were not isolated from turkey flocks in 1999. The serotype distribution is shown in Table 15.

Salmonella was detected in a total of 93 (26.1%) out of 356 flocks examined after slaughter (Table 6, Figure 4).

Duck and goose production

In April 1999, *Salmonella* monitoring was started in duck and goose flocks by ante-mortem examination. Three weeks prior to slaughter, five pair of sock samples were collected from each flock. Herds producing less than 15,000 ducks or 10,000 geese for slaughter per year were excepted.

From May to December 1999, 207 flocks were examined. Of these only 7 were goose flocks. *Salmonella* was isolated from 192 (92.8%) of the flocks. *S.* Hadar was the most frequently isolated serotype found in approximately 25% of the infected flocks (Table 15).

Pigs and pork

A serological surveillance programme for detection of

Table 6. Occurrence of Salmonella *and* Campylobacter *in the turkey production in Denmark in 1999.*

	Flock level		Slaughterhouse		Retail - cuts and products of turkey meat				
	Turkey flocks		Neck skin		Not heat treated		Heat treated		
	Flocks examined	% positive flocks	N	% positive flocks	N	% positive samples	N	% positive samples	Note:
Salmonella spp.	366	6.3	356	26.1	160	8.1	18	0	a
S. Enteritidis	-	0	-	-	-	-	-	-	-
S. Typhimurium	-	0	-	-	-	-	-	-	-
Other serotypes	-	6.3	-	-	-	-	-	-	-
Campylobacter spp.	177	58.8	-	-	351	11.0	-	-	b
C. jejuni	-	54.8	-	-	-	-	-	-	-
C. coli	-	2.3	-	-	-	-	-	-	-
C. lari	-	1.7	-	-	-	-	-	-	-

Data: Danish Veterinary Laboratory and Danish Veterinary and Food Administration

a) Flocks monitored by sock samples 2-3 weeks prior to slaughter and by 50 neck-skin samples at slaughter.

b) Flocks monitored by cloacal swabs at slaugter, ten birds per flock were examined. Summed up in batches, where one flock is slaughtered in 2-4 batches. Monitoring initiated in September 1999.

Salmonella infection in slaughter-pig herds was implemented at the beginning of 1995. All herds producing more than 100 pigs for slaughter per year are monitored by serological testing of meat juice. The herds are assigned to one of three levels based on the proportion of samples with a serological reaction. Level 1: a herd with no or few reactors where intervention is not required; Level 2: a herd with a higher proportion of reactors and where the owner is required to seek advice on how to reduce the prevalence of *Salmonella*; Level 3: the proportion of reactors in the herd is unacceptably high and the owner is required to seek advice and in addition slaughter of pigs from the herd has to be carried out under special hygienic precautions. From August 1996, it was made mandatory for herds in Level 2 and 3 to collect a sufficient number of pen-faecal samples in order to clarify the distribution of *Salmonella* in the herd. Based on the results, an intervention plan must be prepared by the farm advisors. At the end of 1999, 96.9% of the herds fell within Level 1, 2.4% within Level 2 and 0.7% within Level 3. Compared to December 1998, where 2.7% of the herds were in Level 2 and 1.0% in Level 3, there has been a reduction in the proportion of *Salmonella* positive herds, which demonstrates that the intervention strategy used has been effective. However, the proportion of individual meat-juice samples with a serological reaction has not been reduced in the same period (Figure 5), since most seroreactors due to the small number of herds in Level 2 and 3, now belong to the low infected Level 1 herds, where no intervention is required.

Breeding and multiplying herds are monitored monthly by serological testing of blood samples. If a specific cut-off level in these samples is reached, the herd owner is

Table 8. Isolation of Salmonella *from outbreaks of clinical disease in pig and cattle herds in 1999*

Serotype	Pig herds	Cattle herds
Choleraesuis	1	
Derby	5	2
Dublin		65
Enteritidis		4
Heidelberg		1
Infantis	2	
Orion var15+	1	
Putten	1	
Richmond		1
Typhimurium	28	33
	1	6
Typhimirium/rough	1	
Typhimurium/4.12:-	1	
Typhimurium/4.5.12:-:-	1	
Worthington	1	
4.12:-:-	1	
4.12:b	1	
9.12:-		2
Total	44	108

Data: Danish Veterinary and Food Administration.

Table 7. Occurrence of zoonotic pathogens in pigs and pork in Denmark in 1999.

	Herd level			Slaughterhouse				Retail				
	Examined			Cuts of pork		Offal		Not heat treated		Heat treated		
Zoonotic pathogen	Herds	Animals	% positive herds	N	% positive samples	N	% positive samples	N	% positive samples	N	% positive samples	Note:
Mycobacterium bovis	23,387	20.1 mill	0	-	-	-	-	-	-	-	-	a
Brucella abortus	-	-	0	-	-	-	-	-	-	-	-	b
Trichinella spp.	-	-	0	-	-	-	-	-	-	-	-	c
Salmonella spp.	16,062	756,416	3.1	16,399	1.0	3,566	2.9	2,261	1.2	2,078	0	d
S. Enteritidis	-	-	-	-	0	-	0	-	-	-	-	-
S. Typhimurium	-	-	-	-	0.6	-	1.4	-	-	-	-	-
Other serotypes	-	-	-	-	0.4	-	1.5	-	-	-	-	-
Campylobacter spp.	312	312	53.5	-	-	-	-	-	-	-	-	e
C. jejuni	-	-	3.8	-	-	-	-	-	-	-	-	-
C. coli	-	-	49.0	-	-	-	-	-	-	-	-	-
C. lari	-	-	0.6	-	-	-	-	-	-	-	-	-
Y. enterocolitica O:3	293	293	16.4	-	-	-	-	306	3.2	-	-	e f

Data: Danish Veterinary Laboratory and Danish Veterinary and Food Administration
a) All slaughter pigs were examined in connection with meat inspection.
b) Boars examined on admission to semen collection centres and before leaving the station.
c) All pigs slaughtered at export slaughterhouses were examined in connection with meat inspection
d) Herds were monitored by serological testing. Herds belonging to Level 2 and 3 were defined as *Salmonella* positive.
e) Herds examined by caecal samples from one animal per herd collected at slaughter.
f) Isolates from food were not bio- or serotyped, but most were assumed to belong to apathogenic types.

Multi-drug resistant *Salmonella* Typhimurium DT104

Control in primary production

In October 1997, an order regarding multi-drug resistant *Salmonella* Typhimurium DT104 (DT104) was issued by the Danish Veterinary and Food Administration: detection of DT104 in pig and cattle herds was made notifiable. Infected herds are put under official veterinary supervision including special hygiene at slaughter, and epidemiological investigation of the herd and its trade contacts. Two negative herd examinations at 45 days interval are required to lift the sanctions. Sanctions can also be lifted if the herd is destroyed. The order was issued to prevent spread of DT104 between herds as well as from animals to humans. In August 1999, the order was replaced with a new order extending the authorities powers to investigate the spread of DT104. According to this, all animal species on an infected farm and herds associated with the infected herd by e.g. trade of live animals or geographical location, can be ordered examined.

An attempt to eradicate multi-drug resistant *S.* Typhimurium DT104 from infected pig herds was initiated in the beginning of 1997 by the Danish Bacon and Meat Council in co-operation with the Danish Veterinary Laboratory. This programme is based on stamping out the infected herd, including a thorough cleaning and disinfection of the buildings before introducing new pigs at the farm. After reestablishment of the production, the herd is monitored intensively in order to ascertain the success of the eradication.

Occurrence of DT104 in the primary production

During the period from December 1996 to December 1999, 48 domestic animal herds (23 pig herds, 12 cattle herds and 13 combined cattle and pig herds) were found infected with DT104. The number of herds found each year is shown in Figure 6.

DT104 has not been found in Danish poultry.

Monitoring of imported products

In July 1998, a monitoring for the occurrence of DT104 in EU and third country meat was initiated. The samples of imported meat products are collected at the importer.

In 1999, the following fresh meat samples were examined (most samples originated from EU-countries, some from countries outside the EU):

- 2,586 samples of poultry meat, 623 (24.1%) positive for *Salmonella*, 11 (0.4%) samples positive for DT104
- 677 samples of pork, 41 (6.1%) positive for *Salmonella*, 8 (1.2%) samples positive for DT104
- 1,954 samples of beef, 8 (0.4%) samples positive for *Salmonella*, 2 (0.1%) sample positive for DT104

The sero- and phage-type distributions can be seen in Table 15-17.

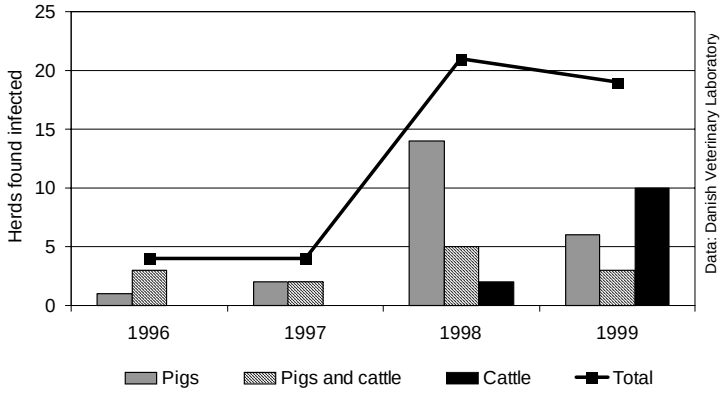

Figure 6: Pig, cattle and mixed herds found infected with multi-drug resistant S. Typhimurium DT104 in Denmark 1996-99.

Table 9. Occurrence of zoonotic pathogens in cattle and beef in Denmark in 1999.

	Herd level			Slaughterhouse				Retail				
	Examined			Cuts of beef		Offal		Not heat treated		Heat treated		
Zoonotic pathogen	Herds	Animals	% positive herds	N	% positive samples	N	% positive samples	N	% positive samples	N	% positive samples	Note:
Mycobacterium bovis	-	580,000	0	-	-	-	-	-	-	-	-	a
Brucella abortus	-	-	0	-	-	-	-	-	-	-	-	b
Salmonella spp.	230	230	0	1,971	0.4	579	1.4	2,440	1.4	602	0.5	c
S. Enteritidis	-	-	-	-	0.1	-	0	-	-	-	-	-
S. Typhimurium	-	-	-	-	0.1	-	0	-	-	-	-	-
S. Dublin	-	-	-	-	0.1	-	1.0	-	-	-	-	-
Other serotypes	-	-	-	-	0.1	-	0.4	-	-	-	-	-
Campylobacter spp.	84	84	50.0	-	-	-	-	-	-	-	-	c
C. jejuni	-	-	48.8	-	-	-	-	-	-	-	-	-
C. coli	-	-	0	-	-	-	-	-	-	-	-	-
C. lari	-	-	1.2	-	-	-	-	-	-	-	-	-
E. coli O157 (VT+)	227	227	3.3	-	-	-	-	-	-	-	-	c
Yersinia enterocolitica	-	-	-	-	-	-	-	136	7.5	-	-	d

Data: Danish Veterinary Laboratory and Danish Veterinary and Food Administration.
a) Bulls at semen collection centres were examined by TB test. Slaughter animals examined in connection with meat inspection. Notifiable disease.
b) Bulls examined on admission to semen collection centres and annually after entry. Clusters of abortions are notifiable. Notifiable disease in cattle.
c) Herds were investigated by caecal samples from one animal per herd collected at slaughter.
d) Isolates from food were not bio- or serotyped, but most isolates were assumed to belong to apathogenic types.

obliged to collect pen-faecal samples. Further, if the serological reactions exceed a specific high level, all movement of livestock from the herd is restricted.

Sow herds producing piglets for slaughter-pig herds placed in Level 2 or 3 are also obliged to collect pen-faecal samples in order to determine the distribution of *Salmonella* within the herd, and to clarify a possible transmission of *Salmonella* from the sow herd to the slaughter-pig herd.

A programme for monitoring *Salmonella* in pork at the slaughterhouses was initiated in July 1993. Approximately 2,250 samples were analysed every month. For each slaughterhouse the number of samples collected is determined by the actual number of animals slaughtered. In 1999, the proportion of *Salmonella* positive cuts of pork varied between 0.5% and 1.6% with a mean of 1.0%, which is at the same level as in 1998 (1.1%). For samples of offal, the proportion of positive samples ranged from 2.0% to 3.7% with a mean of 2.9% (Table 7, Figure 5).

Clinical salmonellosis was recorded in 44 herds (Table 8). This figure was determined by the number of herds submitting material from clinically affected animals to the laboratory. Of these, 24 herds were placed under official veterinary supervision by the district veterinary officer. In the past 50 years, *S.* Choleraesuis has only rarely been found in Danish pig herds. The last finding was in a pig herd in Zealand in 1972. However, in November 1999, *S.* Choleraesuis var kunzendorf was isolated from a pig herd in Northern Jutland. The herd was detected through the serological surveillance programme, and *S.* Choleraesuis was subsequently isolated from the obligatory pen-faecal samples. Two pig-herds supplied by the infected herd were also found positive for *S.* Choleraesuis. All three herds were destroyed and the farmers were compensated for their losses by the Danish Bacon and Meat Council. The source of the infection was not discovered.

Cattle and beef

Herds of cattle are investigated for *Salmonella* on clinical indications and as part of a monitoring programme of the occurrence of antimicrobial resistance in zoonotic bacteria. Salmonellosis was diagnosed in 108 (0.3%) cattle herds in 1999 (Table 8). Of these, 33 herds were placed under official veterinary supervision by the district veterinary officer. The predominant serotypes isolated from clinical cases in cattle in 1999 were *S.* Dublin (60%) and *S.* Typhimurium

(30%) (Tables 8, Table 15). As part of the monitoring programme, 230 caecal samples were collected at slaughterhouses. One animal per herd was sampled and no positive samples were found (Table 9).

At slaughterhouses, approximately 270 samples in total were collected each month from a representative sample of beef cuts and offal. The proportion of positive samples of beef cuts per month ranged from 0.0% to 1.2% during 1999 with a mean of 0.4% (Table 9), which is comparable with 1998 (0.3%). The predominant serotype was *S.* Dublin (55%) (Table 15).

Pet animals, wild mammals and birds

The Danish Veterinary Laboratory monitors the occurrence of *Salmonella* in pet animals and wildlife. The group of wild mammals and birds consists mainly of road kills and animals otherwise dead submitted by hunters, veterinarians and others. Pet animals were investigated on clinical indication only. In 1999, 5 (3.5%) of 144 examined waterfowl were *Salmonella* positive and all isolates were *S.* Typhimurium. The majority of the waterfowl examined were wild geese sampled as part of a project regarding lead pellets in geese. The occurrence of *Salmonella* in pet animals and wildlife is summarised in Table 10.

Products from retail outlets

The Municipal Food and Environmental Laboratories collect samples for monitoring *Salmonella* in meat and meat products at the retail level. A total of 673 broiler and broiler products, 178 samples of turkey cuts and turkey products, 77 samples of duck and duck products, 4,339 samples of pork and pork products, and 3,042 samples of beef and beef products have been examined in 1999. In not heat-treated samples, the prevalences were 8.0% in broilers (Table 5), 8.1% in turkeys (Table 6), 1.3% in ducks, 1.2% in pork (Table 7), and 1.4% in beef (Table 9), respectively. The prevalences in heat-treated products were 0.4% in broilers (Table 5) and 0.5% in beef (Table 9). *Salmonella* was not isolated from heat-treated products of turkey or pork.

Due to a change to a new reporting system, serotype data from the retail level is not available for 1999.

Salmonellosis in humans

In 1999, the registered number of human infections with zoonotic *Salmonella* serotypes was 3,268 (62 cases per 100,000 inhabitants). This number represents a continued decline since 1997 where 5,015 cases were registered. Thus, the incidence in 1999 fell by 16% compared with 1998 (3,880 cases) and 35% compared with 1997, and is now at the same level as 1996 when 3,250 *Salmonella* cases were found (Table 11).

The decrease in 1999 compared with 1998 was mainly due to a lower number of *S.* Enteritidis cases (2,025 compared with 2,674 in 1997, i.e. a 22% reduction, Figure 7). However, the number of *S.* Enteritidis infections remains at same level as in the years before 1997, e.g. 1,771 cases in 1996 and 2,070 cases in 1995. Table 16 shows the phage type distribution of 454 randomly selected *S.* Enteritidis strains from human infections. The major types were PT6 (29%), PT8 (26%), and PT4 (17%). *S.* Enteritidis PT34 is rare in Denmark, and accounted for

Table 10. Occurrence of Salmonella *and* Campylobacter *in pet animals, wild mammals and birds in Denmark in 1999*

	Pet animals						Wild mammals								Wild birds			
	Dog		Cat		Others		Hare		Ruminants		Fox		Others		Water fowl a)		Others	
Zoonotic patogen	Animals	% positive	Animals	% positive	Animals	% positive	Animals	% positive	Animals	% positive	Animals	% positive	Animals	% positive	Birds	% positive	Birds	% positive
Salmonella	11	0	5	0	6	33.3	13	0	18	0	67	4.5	235	1.7	144	3.5	46	0
S. *Enteritidis*		-		-		0		-		-		1.5		0.9		0		-
S. *Typhimurium*		-		-		0		-		-		1.5		0		3.5		-
Others/not typeable/not typed		-		-		33.3		-		-		1.5		0.9		0		-
Campylobacter spp.	229	13.5	111	10.8	18	0	15	0	13	7.7	85	3.5	251	3.6	136	33,8	41	36.6
C. *jejuni*		4.4		2.7		-		-		0		3.5		1.6		21.3		24.4
C. coli		0.4		0.9		-		-		7.7		0		0		0.7		0
C. upsaliensis		1.7		2.7		-		-		0		0		0		0		0
Others/not typeable/not typed		7.0		4.5		-		-		0		0		2.0		11.8		12.2

a) The majority of the waterfowl were wild geese

less than 1% of the infections in 1998. However, in 1999 this strain was found in 12% of the cases. This emergence of phage type 34 was associated with a restaurant-associated outbreak during the summer of 1999. Whereas more than 90% of PT6 and PT8 cases were domestically acquired, 50% of the cases of PT4 had a history of foreign travel. In addition, PT1 was frequently associated with travel. In 1998, PT8 was the major *S.* Enteritidis phage type, accounting for 40% of the cases.

Figure 8 shows the age- and sex-specific incidence of S. Enteritidis in 1999. Figure 9 shows the geographical distribution of the *S.* Enteritidis cases.

It is estimated that approximately 80% of *S.* Enteritidis cases are domestically acquired.

The number of *S.* Typhimurium cases decreased compared with 1998 (584 cases versus 678, i.e. a 14% reduction). The incidence of sporadic cases of *S.* Typhimurium in Denmark has gradually declined since 1994. Table 17 shows the phage type distribution of 437 cases. In 1999, DT104 was in 1999 the most frequent phage type, accounting for 25% of the infections. Other common phage types included DT12 (20%) and DTU288 (9%). The distribution of phage types in 1999 represents a gradual change in the predominating types since 1996 where DT12 accounted for approximately 60% of the *S.* Typhimurium from humans. The increase in *S.* Typhimurium DT104 can in part be expained by two general outbreaks of multidrug-resistant *S.* Typhimurium DT104 in 1999. These outbreaks are briefly described in the next section.

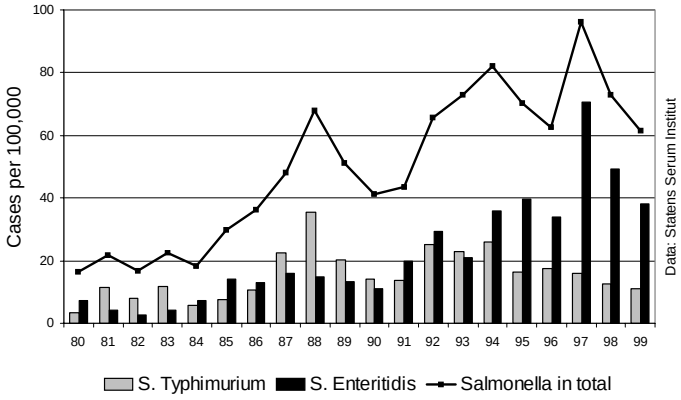

Figure 7. Registered cases of human salmonellosis in Denmark 1980-99.

Figure 10 shows the age-specific incidence of *S.* Typhimurium in 1999 and Figure 11 shows the geographical

Table 11. Zoonoses in humans 1999 - incidence and trends of 5 and 10 years

	1999		Five years trend					10 years	
Agent	Cases per 100.000 inh.	Registrered cases	1998	1997	1996	1995	1994	1989	Note:
Mycobacterium bovis	0.04	2	8	11	11	9	5	9	a
Brucella abortus/melitensis	0	0	0	0	0	0	0	0	a
Trichinella spiralis/nativa	0	0	0	0	0	0	0	0	a
Salmonella spp.	61.5	3.268	3,880	5,015	3,259	3,654	4,276	2.601	b
S. Enteritidis	38.1	2,025	2,607	3,674	1,771	2,070	1,876	689	
S. Typhimurium	11.0	584	678	841	907	848	1,363	1,044	
Other zoonotic serotypes	12.4	659	595	500	581	736	1,037	868	
C. coli/jejuni	78.4	4,164	3,372	2,666	2,973	2,601	2,196	1,432	
E. multilocularis/granulosus	0	0	0	0	0	0	0	0	c
Listeria monocytogenes	0.8	44	41	33	39	29	23	32	d
Rabies	0	0	0	0	0	0	0	0	e
Toxoplasma gondii	-	-	-	-	-	-	-	-	f
Cryptosporidium parvum	-	-	-	-	-	-	-	-	g
Yersinia enterocolitica	6.4	339	464	430	532	779	643	879	
Escherichia coli (VTEC)	1.0	51	34	33	5	2	10	8	
O157 (VTEC)	0.2	10	6	12	3	2	3	1	

Data: Statens Serum Institut.

a) Notification not mandatory. Cases of tuberculosis due to reactivation of latent infections in elderly or imported disease.
b) Only first isolations registered.
c) Notification not mandatory. A few imported cases occur.
d) Notification mandatory from 1986.
e) Notification mandatory. No domestical or imported cases.
f) Notification not mandatory
g) Notification not mandatory. Approximately 180 cases are diagnosed annually, most are imported cases.

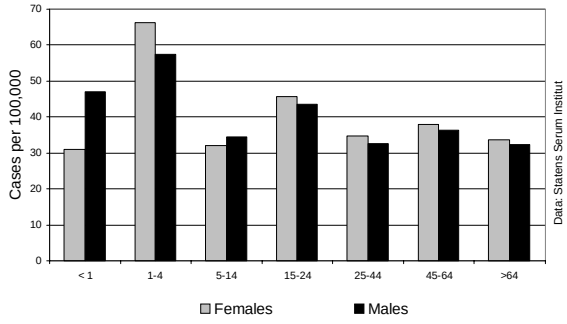

Figure 8. Incidence of infections with S. *Enteritidis by age and sex, 1999.*

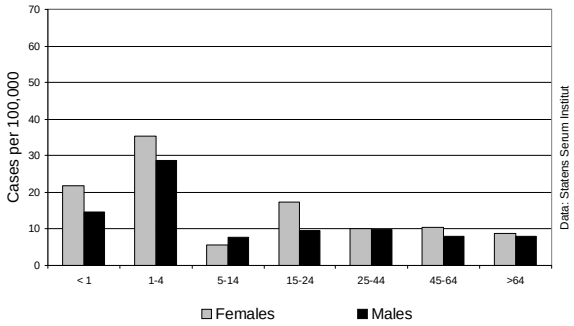

Figure 10. Incidence of infections with S. *Typhimurium by age and sex, 1999.*

distribution of this serotype.

Approximately 90% of *S.* Typhimurium infections are domestically acquired.

The remaining 659 zoonotic *Salmonella* cases were distributed over more than 100 different serotypes. Among these were *S.* Hadar (74 cases), *S.* Agona (60 cases), *S.* Virchow (59 cases), *S.* Newport (49 cases), and *S.* Infantis (30 cases). The numbers of the 'exotic' serotypes rose from 595 in 1998, i.e. an 11% increase. Table 15 shows the distribution of major serotypes.

Outbreaks of zoonotic gastrointestinal infections

In Denmark, outbreaks of food- and waterborne infections caused by zoonotic agents may be detected in three different systems. *Firstly*, physicians in general practice and hospitals are obliged to notify all infections which are suspected to be foodborne. In principle, this should be carried out without awaiting a microbiological diagnosis. These early notifications of suspected outbreaks are submitted to the public health officer in the county with a copy to the department of epidemiology at Statens Serum Institut (Ministry of Health).

Secondly, individuals who experience food poisonings often report these incidents to the local Municipal Food and Environmental Laboratory. These reports as well as the result of the outbreak investigations are collated at the Danish Veterinary and Food Administration.

Thirdly, gastrointestinal

Danmarkskort om S. Enteritidis indsættes

Danmarkskort om S. Typhimurium indsættes

Figure 9. Geographical distribution of the number of cases per county and incidence of human infections with S. Enteritidis in 1999. Data: Statens Serum Institut.

Figure 11. Geographical distribution of the number of cases per county and incidence of human infections with S. Typhimurium in 1999. Data: Statens Serum Institut.

pathogens identified at clinical microbiology laboratories are reported to the department of gastrointestinal infections at Statens Serum Institut, which is reference laboratory for enteric pathogens and in charge of the laboratory surveillance system.

Outbreaks may be detected in either of these three systems. In practice, most family outbreaks are detected by the clinicians and public-health officers as well as the food-safety laboratories, whereas most of the larger general outbreaks in recent years were discovered due to an increase in the number of isolates of a certain pathogen in the laboratory based surveillance. Tables 12, 13 and 14 summarises reports of outbreaks detected in 1999 in the three systems. There is, at the present time, no systematic evaluation of the overlap between the three parallel systems, nor has the completeness of these systems been formally evaluated.

Generally speaking, zoonotic agents may cause "sporadic cases" or outbreaks. It is assumed that patients, whom have not been associated with known outbreaks, are sporadic. However, this may not always be the case. For example, an increase in the number of isolates of a common agent may not be detected because of its high background incidence, or it may be difficult to recognise that the persons who fell ill share a common food source. To determine the burden of disease caused by different agents, it is of little importance to distinguish between cases from outbreaks and "sporadic cases". However, this distinguishing becomes critical when the aim is to evaluate trends and quantify the sources of pathogens. In 1999, several regional outbreaks of zoonotic *Salmonella* became critical for the evaluation of the trend and the quantification of the sources of *Salmonella* infections.

Two of these outbreaks were caused by multi-drug resistant *S.* Typhimurium DT104. The first outbreak was a general outbreak in Ribe county in June 1999. This outbreak included a total of 26 culture confirmed cases. All cases had eaten food from a restaurant in Esbjerg, but in the investigation of the outbreak, disease could not be associated with exposure to a specific food item. However, by inspection at the premises, it was noted that cross-contamination from raw meat to lettuce had occurred. The restaurant had received more than 500 kg of imported pork in the week prior to the outbreak, and this may have been the source of this outbreak. The other outbreak of multi-drug resistant DT104 took place in Aalborg in September 1999 and included 32 culture confirmed cases from two different parties. Food for both these parties were delivered from a local butcher. A cohort study associated infection with roast

Table 12. Clinical based surveillance of suspected outbreaks of food-borne zoonotic diseases notified to Statens Serum Institut, 1999

	General outbreaks		Outbreaks within household	
Zoonotic pathogen	No. of outbreaks	Suspected source	No. of outbreaks	Suspected source
S. Enteritidis	42	Homemade ice cream, cheese cake, cold soufflé and cream, pork, veal, beef, lamb, chicken, turkey, fish, shellfish	27	Egg, homemade ice cream, dessert prepared with raw eggs and cream cake, chicken
S. Typhimurium	8	Hamburger, pork	6	Unknown
Campylobacter	14	Salt meat, poultry, pork, cold soufflé	12	Egg, pork, sausages, chicken, poultry
Others [a)]	9	Hamburger, chicken, egg, soft ice	8	Homemade cream, cream cake, chicken, pizza
Unknown	34	Homemade cold soufflé, buttermilk dish and cream, chicken, beef, pork, sausages, fish, oysters	4	Beef, minced beef, pizza

Data: Dept. of Epidemiology, Statens Serum Institut
a) Other zoonotic *Salmonella* spp. and *Yersinia*

beef, and bacteriological examination of its remnants showed that the roast beef was heavily contaminated with *S.* Typhimurium DT104. However, bacteriological examination of the raw meat remaining from the same batch did not show growth of *Salmonella*. Hence, it may be possible that this incident was caused by cross-contamination during preparation of the roast beef, rather than contaminated raw products.

In the beginning of 1999, an increase in the number of *S.* Typhimurium DTU288 was noted. The cases, in total 25, were in particular from Zealand. Because the main reservoir of DTU288 is porcine, this outbreak was assumed to be due to pork meat. Another outbreak by an unusual *S.* Typhimurium phage type occurred in Funen in August. Five persons who received food from a nursing home's kitchen became ill with *S.* Typhimurium DT22.

These outbreaks of *S.* Typhimurium all have had an impact on the overall phage-type distribution of 1999 (Table 17). Noteworthy, almost half of the numbers of DT104 were associated with known outbreaks.

Likewise, a general outbreak of *S.* Enteritidis PT34 had an impact on the overall *S.* Enteritidis phage-type distribution (Table 16). The outbreak occurred over the summer, and included at least 57 culture confirmed cases. The patients, which belonged to a number of different parties, had attended a popular restaurant in central Copenhagen. The hygiene at the premises was deficient, and *S.* Enteritidis PT34 was found in several environmental samples collected in the kitchen. In addition, one of the cooks had a stool culture positive for *S.* Enteritidis PT34. The restaurant was closed and cleaned on two occasions. Reports of infections with *S.* Enteritidis PT34 stopped only after the second cleaning and a rebuilding of the kitchen.

In 1999, 14 outbreaks caused by *Salmonella* and 5

Table 14. Laboratory based surveillance of outbreaks of food-borne zoonotic diseases diagnosed by Statens Serum Institut, 1999.

Zoonotic pathogen	No. of outbreaks	No. of patients involved	Suspected source (No. of outbreaks)
S. Enteritidis	9	3-43	Eggs (4), unknown (5)
S. Typhimurium	4	7-26	Roast beef (1), pork (1), unknown (2)
Campylobacter	1	4	Turkey
Unknown	1	30	Beef tornedos?

Data: Statens Serum Institut.

Table 13. Outbreaks of food-borne zoonotic diseases registered by the Municipal Food and Environmental Laboratories in 1999.

Zoonotic agent	No. of outbreaks	Total number of sick persons	Suspected source (No. of outbreaks)	Confirmed by culture in foodstuffs/patients
S. Enteritidis	11	312	Chicken, bacon, beef and smoked salmon (1)	-/+
			Deepfried chicken in dough and noodles (1)	+[a])/+
			Roast duck (1)	-/+
			Meatballs, potatoes and fried fish (1)	-/+
			Buffet supper (1)	-/+
			Meatballs of lamb (1)	-/+
			Cakes with raw eggs (2)	-/+
			Cake with raw egg (1)	+/+
			Ice-cream with raw eggs (1)	+/+
			Salmon tatar (1)	-/+
S. Typhimurium DT 104	2	104	Meat, salad and dressing (1)	-/+
			Roastbeef (1)	+/+
S. Senftenberg	1	2	Tortilla with chicken, beef, rice and salad (1)	+/+
Campylobacter	5	23	Beef with potatoes, vegetables and sauce (1)	-/+
			Chicken sausages (1)	-/+
			Chicken, potatoes and sauce (1)	-/+
			Pizza with beef (1)	-/+
			Leg of chicken (1)	-/+
Unknown	27	324		

Data: Danish Veterinary and Food Administration.
a) *Salmonella* was not found in the foodstuff, but in the environment

outbreaks caused by *Campylobacter* were investigated by the Municipal Food and Environmental laboratories (Table 13). A total amount of 441 persons became sick. In 13 outbreaks the suspected foodstuff was produced in approved retailers (general outbreaks). Two of these were the above-mentioned outbreaks caused by *S.* Typhimurium DT104. In 6 outbreaks, the suspected foodstuff was produced in private homes (family outbreaks). Raw eggs in desserts were declining in 1999 as a major source of foodborne outbreaks. This decline is probably a result of the control plan for *Salmonella* in layers and table eggs. A great deal of the general outbreaks in 1999 was due to large production of foodstuff in retailers in too small premises (take away), which presumably increased the possibility for cross contamination.

Risk assessment of sources of human salmonellosis

As described in the previous issue of this report, a comparison of *Salmonella* types isolated from food animals and food with isolates from humans, makes it possible to produce estimates of the number of human cases attributable to certain animal sources.

In 1999 in Denmark, the estimated number of human cases per 100,000 inhabitants that could be attributed to various sources, was as follows: table eggs: 23.7; travel: 9.5; pork: 5.5; beef: 0.5; broilers: 1.0; other poultry (turkeys, ducks and imported poultry of various kinds): 5.6; imported beef and pork: 1.1; outbreaks: 4.6 (Figure 12). Approximately 540 cases (10.1 per 100,000) could not be associated with any specific source, but some of these infections are probably related to pet animals or imported foodstuffs, which are not presently monitored e.g. imported table eggs. Figure 13 shows that Denmark has experienced three waves of human salmonellosis, where the majority of cases has been caused by three distinct sources: broilers in the late 80'ies, pork in the mid 90'ies and eggs in the mid/late 90'ies. At each peak, a new control programme was implemented resulting in a decline of human cases attributable to that particular source.

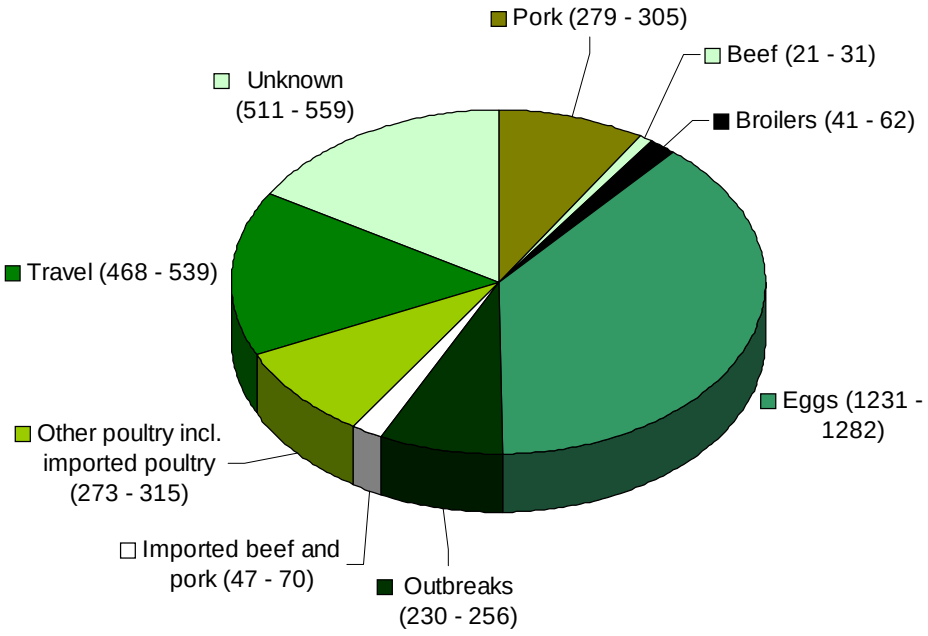

Figure 12. Estimated sources for human salmonellosis in Denmark in 1999 (95% confidence intervals of number of cases). Other poultry includes turkey, duck and imported poultry of various kinds. Data: Danish Zoonosis Centre.

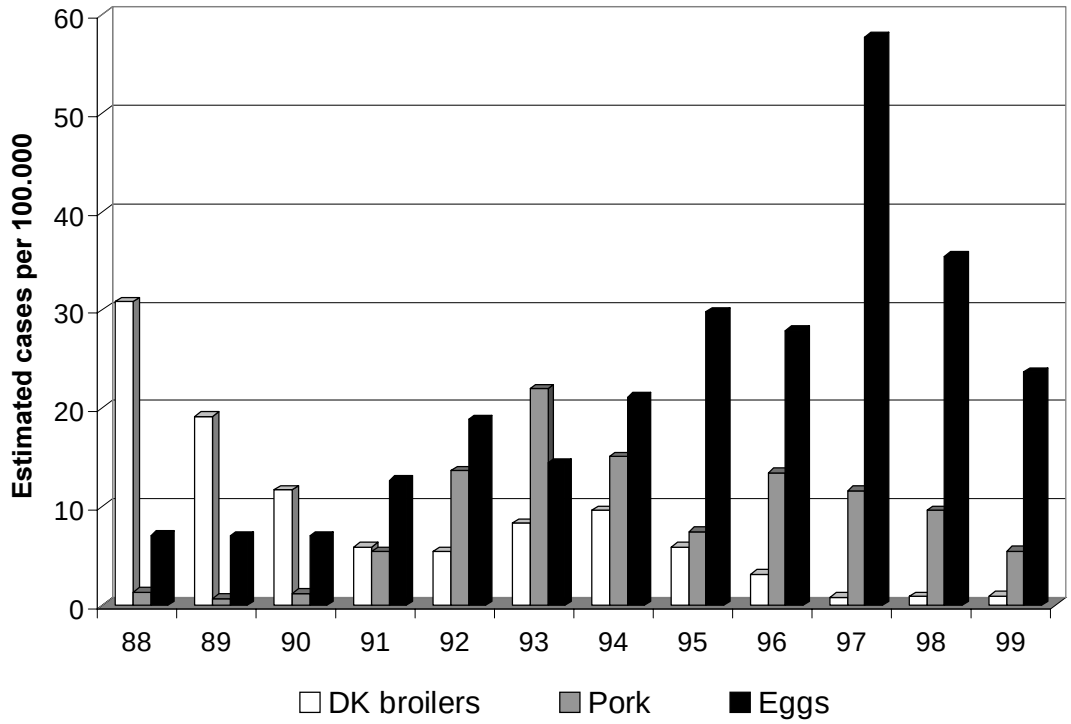

Figure 13. Estimated major sources for human salmonellosis in Denmark, 1988-99. Data: Danish Zoonosis Centre.

Table 15. Serotype distribution (%) of Salmonella *from animals, meat at slaughterhouses, imported meat and humans in Denmark, 1999.*

										Imported meat [f]		
Serotype	Humans	Pig herds [a]	Pork [b]	Cattle herds [c]	Beef [b]	Broiler flocks [d]	Layer flocks [e]	Turkey flocks [d]	Duck flocks [d]	Pork	Beef	Poultry
S. Enteritidis	62.0	0.6	0.3	3.7	5.0	3.5	91.9	0.0	3.1	9.1	0.0	5.2
S. Typhimurium	17.9	70.9	58.2	30.6	10.0	35.3	5.4	0.0	0.4	41.9	37.5	6.8
S. Hadar	2.3	0.0	0.0	0.0	0.0	1.2	0.0	0.0	25.3	0.0	0.0	16.7
S. Agona	1.8	0.4	0.3	0.0	0.0	1.2	0.0	13.0	0.0	0.0	0.0	2.1
S. Virchow	1.8	0.1	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	5.7
S. Newport	1.5	0.0	0.0	0.0	0.0	0.0	0.0	34.8	0.0	0.0	0.0	7.6
S. Infantis	0.9	5.2	8.5	0.0	0.0	16.8	2.7	0.0	0.0	3.6	0.0	5.2
S. Dublin	0.6	0.1	0.3	60.2	55.0	0.0	0.0	0.0	0.0	0.0	62.5	0.0
S. Java	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S. Senftenberg	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S. Stanley	0.6	0.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
S. Saintpaul	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1.8	0.0	5.8
S. Braenderup	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S. Thomson	0.5	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.2
S. Oranienburg	0.3	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
S. Panama	0.3	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S. Derby	0.3	8.1	5.3	1.9	5.0	0.0	0.0	43.5	0.0	7.3	0.0	1.6
Others incl. not typable	7.0	13.8	25.2	3.6	25.0	40.2	0.0	8.7	69.4	36.3	0.0	42.6
Total	100	100	100	100	100	100	100	100	100	100	100	100
Number typed	3,268	1,121	318	108	20	173	37	23	225	55	8	635

Data: Danish Veterinary Laboratory, Danish Veterinary and Food Administration and Statens Serum Institut.
a) Isolates obtained from sampling in slaughter-pig herds placed in Level 2 or 3.
b) Representative meat samples from the surveillance programme at slaughterhouses.
c) Cattle herds examined on clinical indications, data not representative for the Danish cattle population.
d) Representative faecal or sock samples from the mandatory ante-mortem inspection.
e) Representative samples from the surveillance programme in production flocks.
f) Monitoring of imported meat and meat products.

Table 16. Phage-type distribution (%) of S. Enteritidis from humans, animals and imported meat, 1999.

Phage type	Humans	Layer flocks [e]	Broiler flocks [d]	Duck flocks [d]	Pig herds [a]	Cattle herds [c]	Imported meat [f]	
							Poultry	Pork
6	29.1	29.4	50.0	0,0	0,0	25.0	16.7	0.0
8	25.8	50.0	33.3	0.0	42.9	50.0	6.7	0.0
4	16.7	2.9	16.7	0.0	14.3	0.0	73.3	20.0
34	11.5	2.9	0.0	0.0	0.0	0.0	0.0	0.0
1	3.5	0.0	0.0	0.0	0.0	0.0	0.0	60.0
6a	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21b	2.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0
19	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13a	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.4	0.0	0.0	0.0	0.0	25.0	0.0	0.0
21	0.4	0.0	0.0	0.0	0.0	0.0	3.3	20.0
21a	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Others incl. not typeable	5.4	14.8	0.0	100.0	28.5	0.0	0.0	0.0
Total	100	100	100	100	100	100	100	100
Number typed	454	34	6	9	7	4	30	5

Data: Danish Veterinary Laboratory, Danish Veterinary and Food Administration and Statens Serum Institut.
Notes: see Table 15.

Table 17. Phage-type distribution (%) of S. Typhimurium from humans, animals,meat at slaughterhouses and imported meat, 1999.

Phage type	Humans	Pig herds [a]	Pork [b]	Cattle herds [c]	Beef [b]	Broiler flocks [d]	Layer flocks [e]	Imported meat [f]		
								Pork	Beef	Poultry
104	25.2	0.6	0.4	28.9	0.0	0.0	0.0	45.5	67.0	41.9
12	20.1	42.1	41.3	42.2	0.0	6.9	0.0	0.0	0.0	2.3
288	9.2	1.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	4.8	8.8	11.5	2.2	0.0	0.0	0.0	4.6	0.0	0.0
170	4.8	6.9	9.7	4.4	0.0	0.0	0.0	0.0	0.0	0.0
66	4.4	10.0	12.9	2.2	0.0	8.6	0.0	0.0	0.0	0.0
120	4.1	1.0	0.7	0.0	0.0	0.0	0.0	0.0	33.0	14.0
193	3.0	3.9	5.6	0.0	0.0	0.0	0.0	4.6	0.0	2.3
110	2.3	2.0	1.0	4.4	0.0	19.0	100.0	0.0	0.0	0.0
135	1.8	2.1	0.0	0.0	0.0	13.8	0.0	0.0	0.0	0.0
22	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
107	1.4	2.5	0.7	2.2	0.0	0.0	0.0	0.0	0.0	0.0
161	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
302	0.9	0.7	0.0	0.0	0.0	0.0	0.0	9.1	0.0	0.0
10	0.7	2.3	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7
40	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
312	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Others incl. not typable	11.9	15.4	14.1	13.5	100.0	51.7	0.0	36.2	0.0	34.8
Total	100	100	100	100	100	100	100	100	100	100
Number typed	437	843	288	45	2	58	2	22	3	43

Data: Danish Veterinary Laboratory, Danish Veterinary and Food Administration and Statens Serum Institut.
Notes: see Table 15.

2. Campylobacter jejuni/coli

Poultry, pigs, cattle and sheep

In 1998, a national monitoring of thermophilic *Campylobacter* in broilers, hens and ducks was initiated. At slaughter, ten birds per flock were examined by cloacal swabs. The prevalence in broiler flocks was 45% in 1999 (Table 5). The percentage of positive flocks ranged from 24.3% to 77.5% per month, and a distinct seasonal variation was observed (Figure 14). This seasonal variation coincided with human campylobacteriosis in Denmark. In 1999, the prevalence in hens was 60% (50 of 84 examined flocks) and in ducks 95% (158 of 166 examined flocks).

As part of a monitoring programme of the occurrence of antimicrobial resistance in zoonotic bacteria from pigs and cattle, caecal contents were sampled at slaughterhouses and examined for thermophilic *Campylobacter*. One animal per herd was sampled. In pigs the prevalence was 53.5% (Table 7) and in cattle 50.0% (Table 9).

In 1999, a small survey of the occurrence of *C. jejuni/C. coli* in sheep and lamb at slaughter was performed. Of 137 faecal samples, 34 (25%) were positive for *Campylobacter*. The majority of the isolates were *C. jejuni* (88%) and the remaining *C. coli* (12%).

Since the beginning of September 1999, all turkey flocks have been tested for *Campylobacter* at slaughter. Similar to the monitoring of broilers, cloacal swab samples are collected at the slaughterhouse and examined for thermophilic *Campylobacter*. Unlike broiler flocks, turkey flocks are often slaughtered over a period of 2 to 4 days. Since the cloacal swab samples are collected from 10 birds from each batch at slaughter, the same flock may therefore be tested for the presence of *Campylobacter* 2 to 4 times. The results from 1999 are shown in the Table 6.

Screening in cattle herds

In the autumn of 1999, a survey for the within-herd prevalence of *Campylobacter* in dairy cattle farms was made. From each of 24 farm, 15 animals (3 age groups) were examined quantitatively for the excretion of *Campylobacter* in faeces. In 20 farms, between 1 and 9 animals excreted *Campylobacter* (7-60%). A correlation between age and excretion rate/concentration of *Campylobacter* was found. Among calves (< 4 months of age) 46% of the animals were found positive for *Campylobacter* (positive animals excreted on average $3x10^4$ cfu/g faeces), whereas only 9% of the cows excreted *Campylobacter* ($2x10^2$ cfu/g). All isolates belonged to the species *C. jejuni*. Serotyping of five isolates per positive animal showed that in 9 of the 20 farms only one serotype was present, and in the remaining 11 farms 2-4 serotypes were present. Of the positive animals, 10% were colonised with more than one serotype. In total, 10 different serotypes were detected.

Pet animals, wild mammals and birds

The Danish Veterinary Laboratory monitors the occurrence of *Campylobacter*

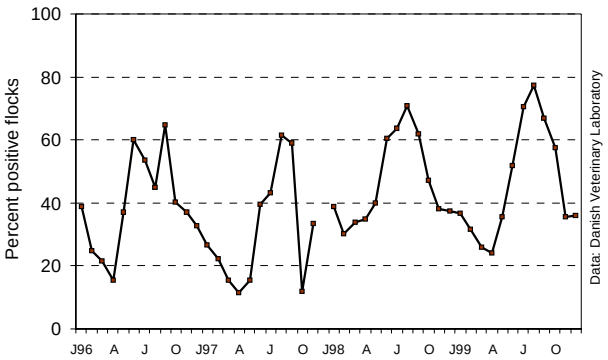

Figure 14. Percent Campylobacter *positive broiler flocks, 1996-99.*

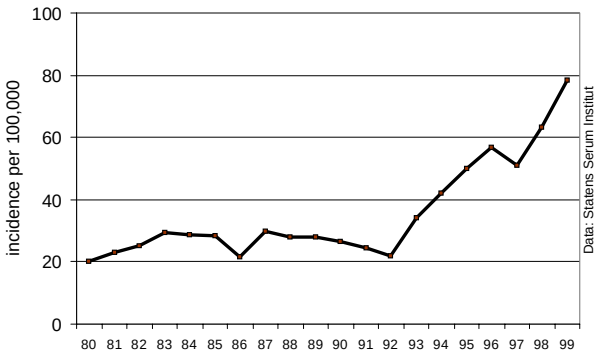

Figure 15. Incidence per 100,000 of human campylobacteriosis in Denmark, 1980-99.

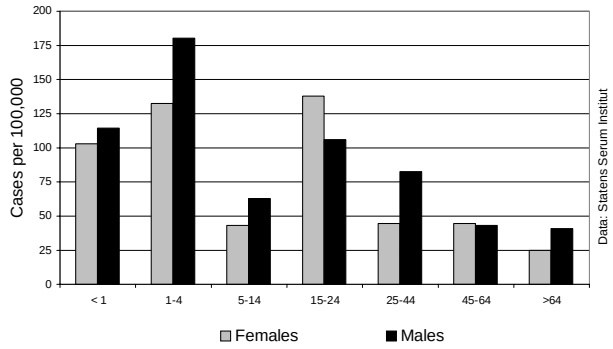

Figure 16. Incidence of infections with Campylobacter *by age and sex, 1999.*

Danmarkskort om campylobacter indsættes

Figure 17. Geographical distribution of the number of cases per county and incidence of human campylobacteriosis in 1999. Data: Statens Serum Institut.

in pet animals and wildlife. The group of wild mammals and birds consists mainly of road kills and animals otherwise dead submitted by hunters, veterinarians and others. Pet animals were investigated on clinical indication only. In 1999, *Campylobacter* was found in 31 (13.5%) of 229 examined dogs and in 12 (10.8%) of 111 examined cats (Table 10). In 1999, 46 (33.8%) of 136 waterfowl examined were positive for *Campylobacter*. Almost all isolates speciated were *C. jejuni*. The majority of the waterfowl examined were wild geese sampled as part of a project regarding lead pellets in geese. The occurrence of *Campylobacter* in pet animals and wildlife is summarised in Table 10.

Products from retail outlets

The nation-wide monitoring programme of thermophilic *Campylobacter* in foods from the retail outlet established in 1996 as a co-operation between the Danish Veterinary and Food Administration and the Municipal Food and Environmental Laboratories continued in 1999. The food investigated in 1999 included raw products of chicken, turkey and other birds. The samples represented both imported products and products of Danish origin. In total, 1,736 samples have been analysed. Beef, pork, shellfish, fruits and vegetables were not included in the survey in 1999. The results for chicken and turkey are shown in Tables 5 and 6, respectively. In the group of other birds (incl. ducks, pigeons, quails and ostriches) the prevalence was 24% (N=391) in 1999 compared to 21% (N=293) in 1998.

Campylobacteriosis in humans

The number of human *Campylobacter* infections increased with 23% from 3,372 cases in 1998 to 4,164 cases in 1999 (78 cases per 100,000 inhabitants). This is the highest registered incidence of *Campylobacter* spp. in Denmark. The number of *Campylobacter* infections started to increase from 1992 (1,129 registered cases), and has been more than tripled during the last five years (Figure 15). Figure 16 shows the age- and sex-specific incidence of *Campylobacter spp.* in 1999. The incidence was highest in children 1 to 4 years of age (172 cases per 100,000) but was also high in the age group 15 to 24 years (135 per 100,000) and infants (118 per 100,000). As mentioned in the Annual Report of 1998, there is no simple explanation for the increased number of *Campylobacter* infections, and the increase is a concern for public health. Similar trends have been observed in other industrialised countries, and may in part be related to increased consumption of poultry. However, the possible sources of C*ampylobacter* infections are multiple, and other factors may play a significant role as well. This issue is discussed further on page 23.

Figure 17 shows the geographical distribution of infections with *Campylobacter* spp.

Approximately 80% of the

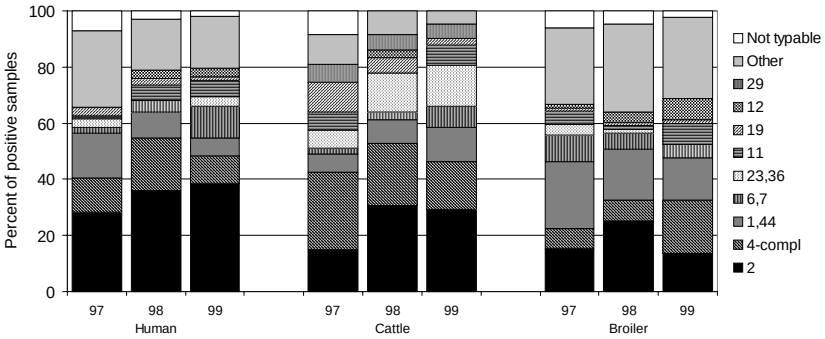

Figure 18. Development in serotype distribution of C. jejuni isolates from human, broilers and cattle in the years 1997 to 1999. Data: Danish Veterinary Laboratory.

Table 18. Serotype distribution (%) of Campylobacter jejuni *from human patients, animals and foods in 1999.*

Serotype	Human	Broilers	Cattle	Sheep	Pigs	Ostrich	Food [a)]
1,44	6.5	15.0	12.2	3.3	0.0	15.4	13.2
2	38.6	13.8	29.3	30.0	7.7	19.2	15.8
3	4.6	0.0	0.0	0.0	0.0	0.0	2.6
4-complex [b)]	10.5	18.8	17.1	26.7	0.0	3.8	5.3
6,7	11.1	5.0	7.3	5.0	9.1	11.5	10.6
11	5.9	7.5	7.3	10.0	18.2	0.0	10.6
12	3.3	7.5	0.0	3.2	0.0	3.8	21.1
19	1.3	1.3	2.4	0.0	0.0	0.0	2.6
21	2.6	5.0	0.0	0.0	0.0	0.0	0.0
23,36	3.3	0.0	14.6	3.3	45.5	15.4	0.0
27	1.3	5.0	0.0	3.3	0.0	3.8	2.6
29	0.0	0.0	4.9	0.0	0.0	0.0	0.0
31	2.0	2.5	2.4	3.3	0.0	0.0	0.0
35	0.0	0.0	0.0	3.3	9.1	3.8	0.0
42	2.0	5.0	0.0	3.3	0.0	11.5	10.5
Others	5.7	11.1	2.5	5.3	1.3	11.8	2.5
Non typable	1.3	2.5	0.0	0.0	9.1	0.0	2.6
Number typed	153	80	41	30	11	26	38

Data: Danish Veterinary Laboratory.
a) Foods: only represented by poultry products
b) 4-complex: reaction with one or more of the following antisera: 4, 13, 16, 43, 50, 64, 65

Table 19. Serotype distribution (%) of Campylobacter coli *from human patients, animals and foods in 1999.*

Serotype	Human	Broilers	Pigs	Ostrich	Foods
5	16.7	37.5	11.8	7.7	7.1
24	16.7	12.5	6.5	15.4	14.3
30	33.3	0.0	16.1	15.4	7.1
34	16.7	0.0	7.5	7.7	0.0
46	0.0	18.8	24.7	0.0	7.1
54	0.0	0.0	6.5	23.1	7.1
59	16.7	12.5	3.2	7.7	28.6
Others	0.0	18.7	20.5	15.3	14.4
Non-typable	0.0	0.0	3.2	7.7	14.3
Number typed	6	16	93	13	14

Data: Danish Veterinary Laboratory.

Campylobacter infections are domestically acquired. The increased number of *Campylobacter* infections does not seem to be related to an increased incidence of travel-related infections.

Serotyping of *Campylobacter*

Isolates of *C. jejuni* and *C. coli* were serotyped using the „Penner serotyping scheme“ (heat-stable antigens). Among human isolates, O:2 was the dominating serotype accounting for 38% of the *C. jejuni* isolated in 1999. Serotype O:2 has shown an increasing tendency since 1995 when serotyping of Danish isolates was initiated. Thus a large part of the increase in cases of human campylobacteriosis in that period can be explained by the increased number of serotype 2-cases, whereas most of the other important serotypes represent almost stable number of cases. Other important human serotypes were O:6,7, O:4-complex, O:1,44, O:11, and O:3 (5-11% each). Other serotypes each accounted for 3% or less (Table 18). The unusually large proportion of serotype O:6,7 among human cases in 1999 could be due to an unrecognised outbreak during the summer.

As for human isolates, the serotypes O:1,44, O:2 and O:4-complex represented about 50% of the *C. jejuni* isolates from broiles and cattle (Table 18). The development in serotype distribution over the last three years are presented in Figure 18 for human, cattle and broilers. Due to the low number of *C. jejuni* isolated from pigs (7%

of thermophilic *Campylobacter*), it has not been possible to evaluate a development in serotypes over the years. But when all *C. jejuni* isolates from pigs (n= 32) obtained during 1995-99 are considered, the serotype distribution is distinct compared to isolates from all other reservoirs: serotype O:23,36 dominated (41%) and O:35 was the second most common (12.5%). All other serotypes were represented by less than 10% of the *C. jejuni* isolates. The most common serotypes among *C. jejuni* isolates from sheep were also common serotypes among cattle, human and broiler isolates (Table 18).

C. coli is the dominant *Campylobacter* species in pigs, whereas less than 10% of the *Campylobacters* in humans and most other sources are *C. coli.* The most common *C. coli* serotypes in pigs were O:46, O:30 and O:5 (Table 19).

Food borne campylobacteriosis – a continuous challenge

Denmark, like several other industrialised nations, has experienced an increase in the number of human *Campylobacter* cases during the last decade, from about 20 cases per 100,000 in 1992 to just under 80 per 100,000 in 1999. The causative organism is almost exclusively *Campylobacter jejuni.* The increasing trend has prompted a considerable research effort, in order to find ways of reducing the human exposure to *Campylobacter.*

The research has targeted a number of areas. The research has included the implementation of programmes to monitor the occurrence of *Campylobacter* in food animals and in food of animal origin. Projects have also been undertaken to determine the risk factors for infection of broiler flocks, one of the very likely sources of human campylobacteriosis. Serotyping of *Campylobacter* has been implemented and is used routinely and there is ongoing research to improve the sensitivity and speed of methods for isolation of *Campylobacter* from faecal material, food samples and from water. Finally, studies are being conducted to further explore the risk factors for infection of humans with *Campylobacter*. These studies include host associated risk factors, and also looks at direct exposure through contact with food animals or pets.

It has been established that the farm environment (wild birds or other domestic animals) are the source of infection for poultry flocks, and it has been demonstrated that maintaining strict biosecurity will significantly reduce the risk that broiler flocks become colonised by *Campylobacter*. The investigations have found no evidence of vertical transmission or infection through contaminated feed.

Application of the Penner system for serotyping *Campylobacter* has shown that while a large number of *C. jejuni* serotypes are present in food animals and humans, the majority of isolates belong to a limited number of different types. Although the prevalence of the individual serotypes differ between the reservoirs, there is significant overlap and it is not possible on the basis of typing to deduce the contribution from the various sources of campylobacteriosis, as has been possible for *Salmonella.*

Studies of human campylobacteriosis has identified a number of risk factors for infection, among them consumption of under-done poultry and meat prepared at a barbecue, however, drinking water may also be a source of infection under certain conditions, as may contact with pets. The results of these studies agree well with studies conducted in other countries. Nevertheless, the cause of the increasing human incidence in recent years remains perplexing and will remain the subject of further research.

3. Yersinia enterocolitica

Pigs and cattle

The majority of Danish slaughter-pig herds are assumed to harbour *Y. enterocolitica* O:3. A serological survey in 1993, showed that 90% of herds and 75% of slaughter-pigs were seropositive. In addition, several bacteriological investigations have shown a within-herd prevalence of approximately 80%.

As part of a monitoring programme of the occurrence of antimicrobial resistance in zoonotic bacteria from pigs, caecal contents were sampled at slaughterhouses and examined for *Y. enterocolitica*. One animal per herd was sampled.

Figure 19. Incidence per 100,000 of human yersiniosis in Denmark, 1980-99.

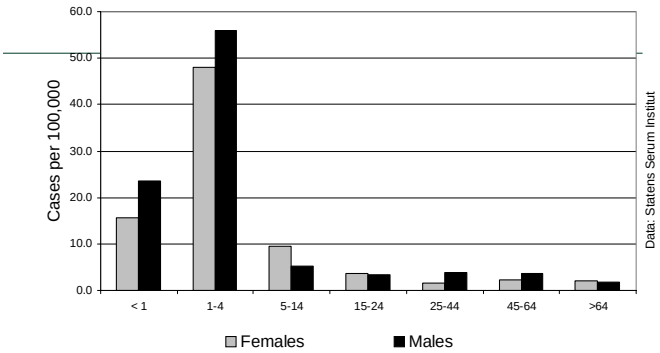

Figure 20. Incidendence of infections with Y. enterocolitica by age and sex, 1999.

In 1999, 48 (16.4%) of 293 examined animals were found positive for *Y. enterocolitica* O:3 (Table 7).

In 1999, *Y. enterocolitica* serotype O:9 was isolated in a cattle herd and a pig herd. While it was the first time this serotype was isolated from pigs, *Y. enterocolitica* O:9 has been detected once before in a cattle herd in 1997. All three herds were examined for the presence of *Y. enterocolitica* O:9 due to positive reactions in the serological *Brucella* tests. *Brucella* spp. was not detected in any of the herds, and in blood samples taken two weeks later decreasing *Brucella* antibody titers were detected. This strongly indicated that *Y. enterocolitica* O:9 was responsible for the positive *Brucella* reaction. The problem with cross reactions in the *Brucella* test due to infection with *Y. Enterocolitica* O:9 is well known in other countries. To avoid introduction of *Y. enterocolitica* O:9 in Danish cattle and pig herds, the involved organisations have voluntary decided to examine all imported animals bacteriologically.

Products from retail outlets

The Municipal Food and Environmental Laboratories collect data on the occurrence of *Y. enterocolitica* in foods sampled at the retail level. In 1999, 3.2% of 306 samples of pork were found positive for *Y. enterocolitica* (Table 7). Of 136 samples of not-heat treated beef 7.5% were found positive for *Y. enterocolitica* (Table 9). The isolates were not bio- or serotyped, but the majority was assumed to belong to the apathogenic types.

Yersiniosis in humans

A total of 339 cases of infections with *Y. enterocolitica* was registered in 1999 (6.4 cases per 100,000 inhabitants, Table 11). The majority, 330, was serotype O:3. In 1998, 464 cases of *Y. enterocolitica* O:3 were registered, i.e., a decrease of 27%. The number of infections with *Y. enterocolitica* has decreased sine 1985 where 1,512 cases were identified (Figure 19). Because most Danish slaughter pigs are assumed to harbour *Y. enterocolitica* serotype O:3 biotype 4, the primary source of yersiniosis is thought to be porcine.

Figure 20 shows the age- and sex-specific incidence of *Y. enterocolitica* infections and Figure 21 illustrates the geographical distributions of infections with *Y. enterocolitica*.

Approximately 50% of the cases are among children less than five years of age, and more than 95% are domestically acquired.

Danmarkskort om Yersinia indsættes

Figure 21. Geographical distribution of the number of cases per county and incidence of human yersinosis 1999. Data: Statens Serum Institut.

4. Listeria monocytogenes

Products from retail outlets

Data from the monitoring of *Listeria monocytogenes* in foods at retail level in Denmark in 1999 was reported by the Municipal Food and Environmental Laboratories.

According to Danish regulations, investigations of the level of *L. monocytogenes* in foods are to be performed on certain ready-to-eat products. The results of these routine examinations are reported to the Danish Veterinary and Food Administration (Table 20).

Listeriosis in humans

In 1999, 44 sporadic cases of listeriosis was registered (0.8 cases per 100,000 inhabitants, Table 11). This is the highest number ever recorded in Denmark (Figure 20). However, this number also includes cases with atypical clinical presentations. In all, 29 cases were presented with septicaemia, 7 with meningitis, 2 were classical maternofoetal cases, 1 septic abortion in 11th week of gestation, 1 spontaneous peritonitis, 1 infected hip osteosynthesis, 1 perirectal abscess, 1 febrile self-limiting diarrhoea, and 1 veterinarian with cutaneous listeriosis. The patients were spread geographical all over the country. Based on serogrouping, ribotyping and pulsed-field gel electrophoresis, no clustering of cases could be identified. Twenty-eight cases were caused by strains of serogroup 4, 13 by serogroup 1 and from 3 patients, the strains were lost before further characterisation was made.

The age-specific distribution of the 44 cases is given in Table 21.

Table 21. Number of listeriosis cases in Denmark in 1999 by age group

Age group (years)	Number of cases
0	3
1-9yrs	3
10-19yrs	1
20-29yrs	0
30-39	2
40-49yrs	2
50-59	5
60-69yrs	12
70-79	13
80+yrs	3
Total	44

Data: Statens Serum Institut.

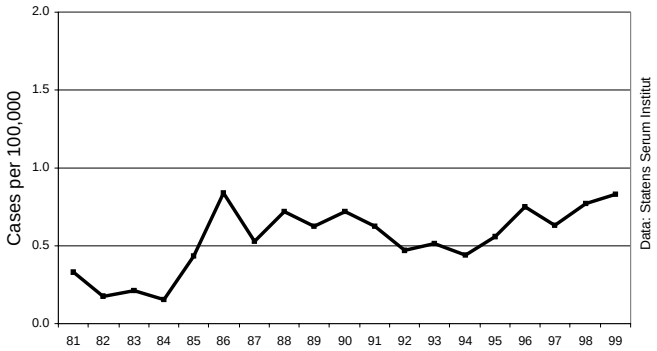

Figure 22. Incidence per 100,000 of human listeriosis in Denmark, 1981-99.

Table 20. Percentage distribution of the number of Listeria monocytogenes *in selected foods, sampled at retail level in Denmark by the Municipal Food and Environmental Laboratories in 1997-99.*

	1999		1998		1997	
	Number of samples	Percent of samples with cfu>100 per g	Number of samples	Percent of samples with cfu>100 per g	Number of samples	Percent samples with cfu>100 per g
Heat-treated products of pork, beef, chicken and turkey handled after heat treatment	5,534	0.5	4,141	0.5	3,640	0.2
Preserved, not heat -treated or slightly heat -treated products of pork, beef, chicken and turkey	212	0.9	512	1.4	174	0.6
Gravad, smoked, salted, not heat-treated or slightly heat - treated fish products	178	0.6	193	0.0	124	2.4
Sprouts or sliced vegetables	398	0.3	505	0.2	203	0.5
Vegetable mayonnaise	2,393	0.2	2,283	0.5	1,642	0.3
Cheese and cheese products	53	0.0	50	0.0	38	0.0
Ready-prepared dishes	1,816	0.0	1,531	0.2	2,675	0.1

Data: Danish Veterinary and Food Administration.

5. Verotoxigenic Escherichia coli

Cattle

The occurrence of verotoxigenic *Escherichia coli O*157 (VTEC O157) has been monitored since 1995 on faecal samples from cattle collected at the slaughterhouse (one sample per herd, monthly sampling). In 1999, VTEC O157 was detected in 7 (3.3%) of 227 faecal samples from cattle (Table 9).

From August to October 1999, the Danish Veterinary Laboratory in co-operation with the Danish beef and dairy industry carried out a screening of the prevalence of VTEC O157 in dairy cattles in a limited area in Denmark. The study included 60 dairy cattle farms from which approximately 2,400 faecal samples were collected. In 10 (17%) of the farms, VTEC O157 was excreted by at least one of the approximately 40 animals tested. In total, 3.6% of all faecal samples were positive for VTEC O157, which is in agreement with the results from the country-wide monitoring. In the positive herds, an average of 20.8% of the animals were infected. In the beginning of the study, carcasses of slaughter animals from positive herds were swabbed and subsequently heat treated in case VTEC O157 was isolated. Of 115 samples of carcasses, 3 (2.6%) were positive. Because of the low prevalence, the sampling of carcasses was stopped.

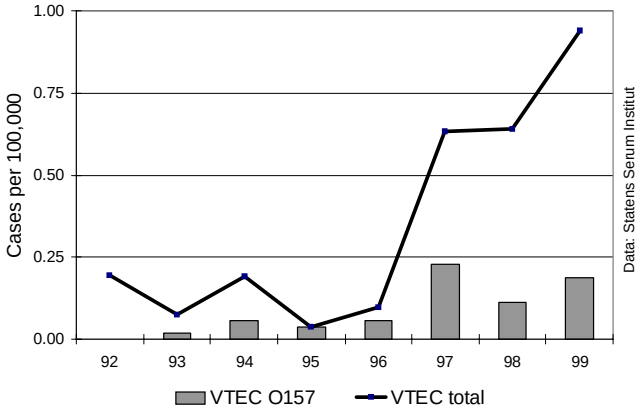

Figure 23. Incidence of human infections with verotoxigenic E. coil*, 1992-99.*

Products from retail outlets

In 1999, a survey for VTEC O157 was performed on meat from farmed deer and sheep using the procedure of NMKL No. 164, 1999. Eighty-four samples of deer meat and 332 samples of sheep meat were analysed. No samples were positive for VTEC O157.

Human infections

The problem of zoonotic *E. coli* infections remains low in Denmark, and no domestically acquired food associated outbreaks have been identified. Before 1997, VTEC was rarely looked for in humans. In 1997, laboratories covering more than 2/3 of the stool cultures performed in Denmark changed their diagnostic practice and began to look for VTEC in all stools from patients with grossly bloody diarrhoea and in all stools from patients 4 years of age or less with a history of bloody diarrhoea. Additionally stools from patients

Danmarkskort om E. coli (VTEC) indsættes

Figure 24. Geographical distribution of the number of cases per county and incidence of human infections with verotoxigenic E. coli *(VTEC), 1999. Data: Statens Serum Institut*

evaluated for traveller's or persistent diarrhoea have been cultured for VTEC. The methods used were a combination of colony hybridisation using probes for verotoxin and eae genes, and live slide agglutination of suspect colonies with O-antisera against the most common VTEC and EPEC serotypes. This approach resulted in the identification of a total of 51 VTEC infections in 1999 (incidence 1.0 per 100,000, Table 11, Figure 23). O:H serotypes were available in 48 of these cases: 11 (23%) were O157:H7 (incl. three non-motile), 9 (19%) O103:H2, 6 (13%) O26:H11, and 6 (13%) O117:K1:H7. The remaining 16 strains belonged to the following O:H serotypes: O45:H-, O55:H7, O91:H21/H- (two cases), O92:H11, O+:H18, O104:H7, O118:H16, O121:H19 (three cases), O137:H6, O145:H- (two cases), O156:H+ and OX177H-. There were four cases of haemolytic uraemic syndrome (HUS): 3 in patients infected with O157:H7 cases and 1 in a patient infected with O137:H6. Table 22 shows the age- and sex-specific incidence whereas Figure 24 shows the geographical distribution. The regional differences are most likely due to different diagnostic practices.

Table 22. Incidence of infections with verotoxigenic E. coil *(VTEC) by age and sex, 1999.*

Age group (years)	Number of cases			
	Female	Male	Total	Cases per 100,000
<1	1	2	3	4.5
1-4	6	7	13	4.7
5-14	3	2	5	0.8
15-24	4	3	7	1.1
25-44	9	3	12	0.8
45-64	1	4	5	0.4
65+	1	5	6	0.8
Total	25	25	51	1.0

Data: Statens Serum Institut

6. Mycobacterium bovis

In accordance with Commission Decision 97/76/EEC, Danish cattle herds are declared officially free from bovine tuberculosis (TB) since 1980. TB in cattle is a notifiable disease in Denmark. Monitoring is performed by meat inspection, which means that all slaughter animals are examined for lesions indicative of TB. Bulls at semen collection centres are subject to pre-entry and annual intradermal tuberculin testing. The last case of TB in cattle was diagnosed in 1988.

In 1988-89, 13 deer farms were found infected with bovine tuberculosis, and until 1994 another 3 farms were found affected. Eradication measures were taken and restrictions have now been lifted on all 16 farms. All deer farms were surveyed through tuberculin testing of animals more than 1 year old or through meat inspection of slaughtered animals. After December 1994, bovine tuberculosis has not been diagnosed in deer in Denmark.

In 1999, 2 cases (0.04 cases per 100,000 inhabitants, Table 11) of human tuberculosis caused by M. *bovis* were registered. These cases are regarded as reactivation of a latent infection acquired before the eradication of bovine TB in cattle. Bovine tuberculosis in humans is no longer a notifiable disease in Denmark.

7. Brucella abortus/ melitensis

In accordance with Commission Decision 97/175/EEC Denmark has been regarded officially free from brucellosis in cattle since 1979. Brucellosis is a notifiable disease, and clusters of abortions are notifiable. Monitoring is performed by examination of abortion material. Bulls are subject to serological testing before entering bovine semen collection centres. After entry they are examined annually for brucellosis.

Boars at porcine semen collection centres are likewise subject to pre-entry testing, followed by testing at least every 18 months and before they leave the centre. In 1999, one case of *B. suis* biotype 2 occurred in a free-range pig herd. This type was last seen in 1994 in another free-range pig herd in the same area and was subsequently detected in wild hares.

No domestically acquired human cases but a few imported cases occur each year. The infection in humans is not notifiable in Denmark.

8. Trichinella spiralis/ nativa

All pigs slaughtered at Danish export slaughterhouses are examined for *Trichinella spp.* in accordance with Council Directive 64/433/EEC, Annex 1, Chapter VIII. Trichinella has not been found

in Danish pigs since 1930. During 1999, all pigs slaughtered at export slaughterhouses were examined by the digestion method, all with a negative result (Table 7).

No domestically acquired cases of human trichinosis were recorded in 1999. A few imported cases occur annually. The infection in humans is not notifiable.

9. Echinococcus granulosus/multilocularis

Echinococcus granulosus infections in all animals are notifiable. Surveillance for *Echinococcus* is performed through meat inspection. In 1999, no cases of *Echinococcus* infections were reported.

No domestically acquired human cases but a few imported cases occur annually. The infection in humans is not notifiable.

10. Toxoplasma gondii

Toxoplasmosis in humans is not a notifiable disease in Denmark, and the incidence of toxoplasmosis in humans is unknown. A recent study including 65,000 seronegative women showed that the incidence is low; only 0,2% seroconverted during pregnancy (1999).

11. Cryptosporidium parvum

Cryptosporidiosis is not a notifiable disease in Denmark. It is estimated that approximately 180 human cases are diagnosed in Denmark annually. Most of these are acquired abroad.

12. Rabies

Rabies is a notifiable infection in both humans and animals. In 1999, 10 bats were found infected with European bat lyssa virus. None of the infected bats had bitten humans. No human cases were reported in 1999, but 16 people were treated by prophylactic vaccination after exposure in Denmark to bat bites or other animals suspected of being infected. In addition 60 people were treated by prophylactic vaccination after exposure abroad to bat bites or other animals suspected of being infected. Sylvatic rabies (genotype 1 lyssa virus) was not found in domestic animals, pet animals or wildlife in 1999.

Antimicrobial resistance

For information on antimicrobial resistance in zoonotic bacteria we refer to the yearly report: "DANMAP - Consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, food and humans in Denmark". The 1999 report will be available at:

http://www.svs.dk

or can be ordered from the Danish Zoonosis Centre (sca@svs.dk) by the end of June 2000.

Serological analysis of eggs sent in by farmers as part of the Danish Salmonella *Surveillance and Control Programme in the table-egg production. After a bar-code labelling, the egg shells are crushed and the egg yolks are analysed for the occurrence of* Salmonella *antibodies.*