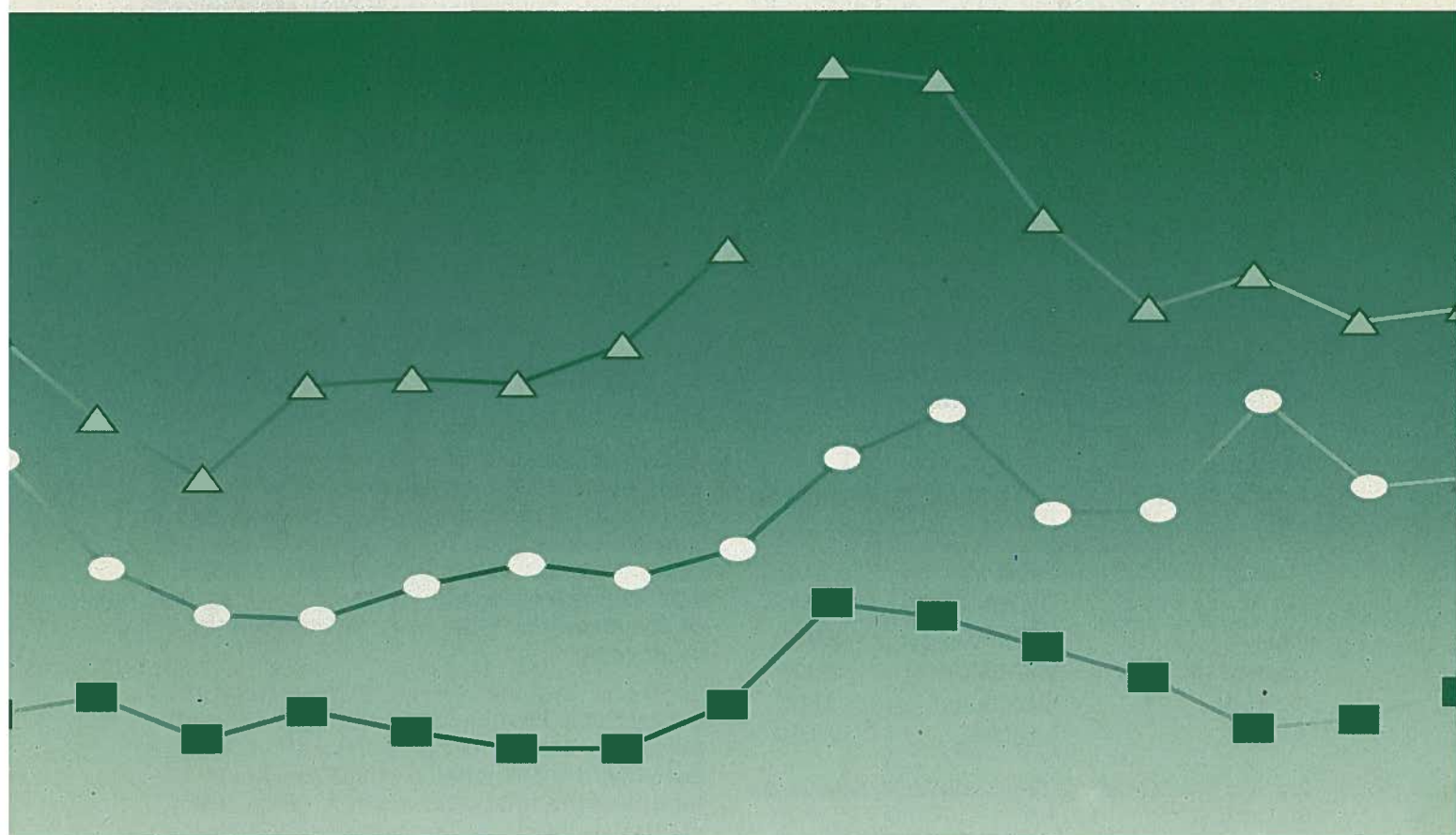




Annual Report on zoonoses in Denmark 1994



Ministry of Agriculture and Fisheries
Danish Veterinary Service
Danish Zoonosis Centre

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(Paragraph 1, Article 5, Council Directive 92/117/EEC)

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Introduction

In March 1995, revision 3 of the Danish plan for implementation of the Zoonosis Directive (hereafter called "the Danish plan") was submitted to the Commission. For each section of this report the relevant articles and paragraphs of the Danish plan are noted in brackets. In other words, if the reader is interested in knowing more about the origin and method of the collection of the data, this may be found in the plan.

The data of this report have been collected from the institutions and laboratories mentioned in the Danish plan. The editing of the report, as well as the footnotes and comments to the tables, has been done in cooperation between the Danish Zoonosis Centre and the Danish Veterinary Service (please refer to annex 1 of the plan).

Total number of livestock and herds in Denmark, 1993:

	Livestock	Herds
Cattle	2200000	33700
Pigs	11568000	26900
Laying hens	4222000	10300
Broilers	13400000	1000
Sheep	160000	5100

Source: The Statistical Yearbook 1994, Danmarks Statistik.

It should be noted that the majority of the egg production takes place in 300 holdings; that nearly all of the broiler production takes place in 330 holdings; and that 85% of the production of slaughter pigs takes place in 7,000 holdings.

Approximate total number of animals slaughtered in 1994:

Cattle:	750000
Pigs:	19 mill.
Broilers:	115 mill.

Denmark covers an area of 44 000 sq km and has a population of 5 mill. people of which over 1 mill. live in the Copenhagen area.

1. Salmonella in feeding-stuffs (7)

All Danish feed compounders are monitored routinely for Salmonella by the Danish Plant Directorate. Monitoring includes routine collection of samples from compound feeds and straight feeding-stuffs, during feed processing and from raw materials, including raw materials of animal origin. Table 1 shows the results of this monitoring.

Control of hygiene at rendering plants is carried out by the animal health section of the Danish Veterinary Service. The products are routinely examined for Salmonella. In 1994 only one sample of the final products from rendering plants was found contaminated with Salmonella. The serotype found was S. Putten.

2. Zoonotic agents in poultry and poultry products (4.1, 6.2)

Samples from rearing and breeding establishments and from hatcheries have been collected according to the requirements of the Zoonosis Directive and examined at the Danish Veterinary Laboratory. The total number of establishments is approximately: 30 rearing herds, 90 breeding herds and 10 hatcheries.

During 1994 25 flocks were suspected of infection with *S. Enteritidis* or *S. Typhimurium* due to isolations of bacteria in hatching material. By examination of 60 killed hens from the suspected flocks, the infection was confirmed in 11 flocks, 6 were infected with *S. Enteritidis* and 5 with *S. Typhimurium*. All infected flocks were parent stock to the broiler production. The eggs were heat treated or destroyed and the hens slaughtered according to the requirements of the Directive.

Salmonella was monitored continuously by ante mortem control of all broiler flocks. Sixteen caecum samples were collected per flock 2-3 weeks prior to slaughter (Table 2.1). The percentage of positive flocks ranged from 11.9% to 20.4% per month. In December the sampling method was changed to faecal samples as described in the Danish plan. This resulted in a considerable increase in the number of positive flocks found. The increased sensitivity of the detection method is expected to help to reduce the number of infected broilers after slaughter by improving the ability of the slaughterhouse to differentiate between infected and non infected flocks at slaughter. Furthermore, persi-

stent infections in broiler houses as well as rearing and breeding establishments and hatcheries are more likely to be identified.

A nationwide screening of 8,300 samples of neck skin from individual animals showed that a total of 36.4% of the broilers were positive for *Salmonella* after slaughter (Table 2.1). The continuous *Salmonella* monitoring at the slaughterhouses is based on pooled neck skin samples, as described in the Danish plan. This monitoring showed that a total of 64% of the flocks yielded *Salmonella* infected broilers after slaughter during 1994.

The serotype distributions of *Salmonella* in the flocks at slaughter and at the retail level were largely identical.

The prevalence of *Campylobacter* was only investigated in 2 relatively small surveys (Table 2.1).

Listeria monocytogenes was not found during screening investigation in 2,078 samples randomly collected from 130 broiler flocks but was frequently found at 7 different slaughterhouses during the same investigation, indicating that the slaughterhouse is probably the best target for prevention and control (Table 2.1).

A survey of *Listeria monocytogenes* in broiler products at retail outlets was performed in 1994; the results are shown in Table 2.1.

The screening programme for *Salmonella* in the commercial egg production is carried out as described in the Danish plan. In 1994, 306 (93%) flocks of layers were found to be free from *Salmonella*, whereas 24 (7%) were found to harbour *Salmonella*: *S. Enteritidis* (8 flocks), *S.*

Table 1. Control of *Salmonella* in compound feeds and feed processing 1994

	Control of compound feeds			Process control	Control of raw materials and straight feeding-stuffs					
	Pig feed	Cattle etc. 1)	Poultry feed							
Total number of samples	2330	1477	562	2892	630					
<i>Salmonella</i> not detected	2312	1447	559	2771	615					
<i>Salmonella</i> detected	18	30	3	121	15					
Percent positive	0.8%	2.0%	0.5%	4.2%	2.4%					
Serotypes:										
	<i>S. Derby</i>	3	<i>S. Agona</i>	4	<i>S. Havana</i>	1	<i>S. Agona</i>	1	<i>S. bredeney</i>	1
	<i>S. Lexington</i>	1	<i>S. Amsterdam</i>	1	<i>S. 4.12:b:-</i>	2	<i>S. Alachua</i>	1	<i>S. Dublin</i>	1
	<i>S. Levingstone</i>	1	<i>S. Derby</i>	2			<i>S. Derby</i>	1	<i>S. Lexington</i>	1
	<i>S. Mbandaka</i>	1	<i>S. Eastglam/Ruiru</i>	1			<i>S. Havana</i>	6	<i>S. Putten</i>	5
	<i>S. Montevideo</i>	1	<i>S. Gaminara</i>	1			<i>S. Infantis</i>	1	<i>S. Schwarzengrund</i>	1
	<i>S. Ohio</i>	1	<i>S. Havana</i>	2			<i>S. Kentucky</i>	2	<i>S. Senftenberg</i>	1
	<i>S. Senftenberg</i>	1	<i>S. Mbandaka</i>	1			<i>S. Kibusi</i>	1	<i>S. Tennessee</i>	1
	<i>S. Tennessee</i>	1	<i>S. Pomona</i>	1			<i>S. Liverpool</i>	1	<i>S. Typhimurium</i>	1
	<i>S. 4.12:b-</i>	7	<i>S. Senftenberg</i>	3			<i>S. Mbandaka</i>	8	<i>S. 4.12:b:-</i>	3
			<i>S. Tacksony</i>	1			<i>S. Meleagridis</i>	2		
			<i>S. Tennessee</i>	5			<i>S. Montevideo</i>	2		
			<i>S. Thompson</i>	1			<i>S. Ohio</i>	5		
			<i>S. Typhimurium</i>	1			<i>S. Orion</i>	3		
			<i>S. 1.4.12:d:</i>	2			<i>S. Orion var. 15+</i>	1		
			(monophase)				<i>S. Othmarschen</i>	1		
			<i>S. 4.12:b:-</i>	4			<i>S. Ouakam</i>	3		
							<i>S. Rissen</i>	1		
							<i>S. Senftenberg</i>	6		
							<i>S. Tacksony</i>	1		
							<i>S. Tennessee</i>	11		
							<i>S. 4.12:b:-</i>	57		
							<i>S. 6.7:- (non phase)</i>	1		
	<i>Salmonella</i> detected, not typable	1					<i>Salmonella</i> detected, not typable	5		

¹ Includes feed for cattle, horses, sheep and rabbits

4,12:b:- (6 flocks), *S. Infantis* (6 flocks), *S. Typhimurium* (3 flocks) and *S. Livingstone* (1 flock). This is an increase from 1992 and 1993 where only 2% of the flocks were found to harbour *Salmonella*. However, the true increase in the level of infection is uncertain, as the laboratory method was changed in 1994.

3. Zoonotic agents in pigs and pork products (4.2, 6.2)

Examination in 1994 of all carcasses of slaughter pigs (approx. 19 million) showed that Danish pigs were free from *Trichinella* infections, as they have been since 1929. *Trichinella* was diagnosed in Denmark in 1994 in a wild fox.

The presence of *Salmonella* in pig herds and pork has been in focus during 1994. A microbiological screening programme of all pig herds producing more than 2,600 pigs per year, and 156 herds producing between 500 and 550 bacon pigs per year (a total of 1,363 herds), was performed during the second half of 1993 and first half of 1994. The screening was carried out by microbiological examination of ten samples of caecum content per herd. Samples were collected at the slaughterhouse. The results of the screening are shown in Tables 3.1 and 3.2. Differences were observed between different regions of the country. On the island of Bornholm *Salmonella* was detected in only 7.1% of the herds, whereas on the island of Funen a total

of 34.5% herds were positive. The serotype distribution is shown in Table 3.1. It is noteworthy that *Salmonella Choleraesuis* is not present in Danish pig herds.

A serological test for detection of *Salmonella* infection in pig herds was evaluated during 1994. The evaluation was done on the basis of 2 x 20 samples from approximately 1,900 large herds, collected from pigs at slaughter during the second and third quarters of 1994. The herds were divided into three groups based on the number of samples with a serological reaction: group 1 (<20% positive samples), group 2 (21-50% positive samples) and group 3 (>50% positive samples). In this investigation 86.8% of the herds fell within group 1, 8.5% within group 2 and 4.7% within group 3. The serological test has been adopted as a routine method for a nationwide monitoring and control programme since January 1995 as described in the Danish plan.

A continuous programme for monitoring of *Salmonella* in pork at the slaughterhouses was initiated in July 1993. A total of approximately 2,500 samples are analysed every month. For each slaughterhouse the number of samples collected is determined by the actual number of animals slaughtered, as described in the Danish plan. The number of *Salmonella* positive fresh meat samples showed a decreasing trend through most of 1994. In January, a total of 1.9% of the samples of fresh pork harboured

Table 2.1. Occurrence of zoonotic pathogens in broilers and broiler products in Denmark, 1994

Category	Zoonosis	Agent	Flock level			Slaughterhouse		Retail - broilers and products of broiler meat				Note
			Examined		% positive flocks	Neck skin		Not heat treated		Heat treated		
			Flocks	Animals		N	% positive samples	N	% positive samples	N	% positive samples	
I	Salmonellosis	<i>Salmonella spp.</i>	4168	66688	17.9	8300	36.4	663	16.1	968	0.2	
		<i>S. Enteritidis</i>			2.4		0		1.5		0	
		<i>S. Typhimurium</i>			10		24.8		5.6		0.1	
		Other serotypes			6.7		11.6		9		0.1	
II	Campylobacteriosis	<i>C. coli/jejuni</i>	33	330	33	0		141	37	0		a
		<i>L. monocytogenes</i>	130	2078	0	280	25	4	25	9	11	b

Notes:

- a Collected as a part of a survey 1994.
- b Collected as a part of a survey 1993/1994.

Table 2.2. Occurrence of zoonotic pathogens in layers and eggs in Denmark, 1994

Category	Zoonosis	Agent	Animal flocks			Retail/whole sale - eggs				Note	
			Examined		% positive flocks	Not heat treated		Heat treated			
			Flocks	Animals		N	% positive eggs	N	% positive		
I	Salmonellosis	<i>Salmonella spp.</i>	330	33000	7.3	10,155	0.1		0		a
		<i>S. Enteritidis</i>			2.4		0.02				
		<i>S. Typhimurium</i>			0.9		0.04				
		Other serotypes			3.9		0.04				
II	Campylobacteriosis	<i>C. coli/jejuni</i>	0			0			0		
		<i>L. monocytogenes</i>	0			0			0		

Notes:

- a Monitoring of flocks of egg layers has been carried out by examining 100 rectal swabs taken a few weeks before slaughter of each flock. Eggs from whole sale and retail outlets were collected and investigated as a part of a national screening in the autumn of 1993.

Salmonella. In December this number had decreased to only 0.7% of the samples. The reason for this is probably an improved ability of slaughterhouses to slaughter pigs under hygiene precautions in accordance with the Salmonella status of the herds. The distribution of serotypes in pork at the slaughterhouses largely reflects the

Table 3.1. Serovar distribution of Salmonella in Danish pig herds. The results of the screening of Danish pig herds for Salmonella enterica serovars performed from October 1st, 1993 to March 10th, 1994

Serovar	No. of positive herds	% of positive herds
S. Typhimurium	182	61.1
S. Infantis	32	10.6
S. 4, 12:b:-	25	8.3
S. Derby	12	4.0
S. Panama	15	5.0
S. Livingstone	7	2.3
S. Worthington	5	1.7
S. Mbandaka	6	2.0
S. Orion var. 15+	3	1.0
S. Bredeney	2	0.7
S. Gaminare	1	0.3
S. Berta	4	1.3
S. Enteritidis	3	1.0
S. Putten	2	0.7
S. Heidelberg	2	0.7
S. London	1	0.3
S. Ohio	2	0.7
S. Pomona	3	1.0
S. Saintpaul	1	0.3
S. Senftenberg	2	0.3
S. Agona	1	0.3
S. Anatum	1	0.3
S. Bochum	1	0.3
S. Dublin	1	0.3
S. Give	1	0.3
S. Indiana	1	0.3
S. Meleagridis	1	0.3
S. Montevideo	1	0.3
S. Munchen	1	0.3
S. Tennessee	1	0.3
Total	302 a)	100

a) Eighteen of 302 herds were infected with two serovars

distribution of serotypes in the herds (data not shown).

At the retail level, Salmonella was found in a total of 2.5% of the samples of fresh pork and 0.06% of the samples of heat treated pork (Table 3.2). The total number of samples per month is too small to allow us to estimate any trends at this level. The serotype distribution largely reflects the serotypes found in the herds and at slaughter.

A screening for *Listeria monocytogenes* in samples of fresh and processed pork was performed in 1994. The results are shown in table 3.2.

Other zoonotic pathogens, notably *Yersinia* and *Campylobacter* have not been investigated in 1994. A survey of *Campylobacter* in pork at retail outlets will be carried out during 1995.

4. Zoonotic agents in cattle, beef, milk and milk products (4.2, 6.2)

Data regarding the occurrence of zoonotic agents in herds of cattle and in beef are summarized in Table 4.

All slaughter animals are examined for pathological lesions indicative of bovine tuberculosis (TB) during meat inspection. Routine TB testing has not been carried out in cattle since 1980. The last case of bovine TB in cattle was diagnosed in 1988. Bovine tuberculosis was diagnosed in farmed fallow deer in 1988. The deer herd in question was found to be heavily affected, and all animals were destroyed. A national programme for eradication of bovine tuberculosis in farmed deer was initiated, and during 1988-89 another 12 herds were found to be infected. One herd was found in 1991, one in 1993 and

Table 3.2: Occurrence of zoonotic pathogens in pigs and pork

Category	Zoonosis	Agent	Herd level			Slaughterhouse				Retail				Note	
			Examined		% positive herds	Cuts of pork		Offal		Not heat treated		Heat treated			
			Herds	Animals		N	% positive samples	N	% positive samples	N	% positive samples	N	% positive samples		
I	Tuberculosis	<i>M. bovis</i>	22000	19 mill.	0		0		0		0		0	a	
	Brucellosis	<i>B. abortus</i>			0									b	
	Trichinosis	<i>Trichinella spp.</i>	22000	19 mill.	0		0		0		0		0	c	
	Salmonellosis	<i>Salmonella spp.</i>		1363	13468	22.2	15891	1.3	9983	6.1	2071	2.5	7583	0.06	d
			<i>S. Enteritidis</i>			0.4		0.01		0.01		0.1		0	
<i>S. Typhimurium</i>					13.4		0.8		4.3		2.2		0.04		
	<i>Other serotypes</i>			8.5		0.5		1.8		0.2		0.02			
II	Campylobacteriosis	<i>C. coli/jejuni</i>	0	0		0		0		0		0			
	Listeriosis	<i>L. monocytogenes</i>	0	0		0		0		250	25	383	7		
	Toxoplasmosis	<i>T. gondii</i>	0	0		0		0		0		0			
	Yersiniosis	<i>Y. enterocolitica</i>	0	0		0		0		0		0			

Notes:

- a All slaughter pigs examined during meat inspection.
- b Boars examined on admission to AI stations, no cases found in 1994. One clinical outbreak with *B. suis* biotype 2 occurred in a herd of free range sows and boars.
- c All slaughter pigs examined in connection with meat inspection.
- d Results of a microbiological screening of large pig herds (>2600 pigs slaughtered/herd/year) during October 1993 to March 1994. A detailed table of Salmonella serotype and distribution is shown in Table 3.1

one in 1994 bringing the total up to 16 infected deer herds. Restrictions have been lifted on all 16 infected premises, so that no herds are considered infected at present.

Herds of cattle are only investigated for salmonella infection on clinical indications (salmonellosis). Salmonellosis was diagnosed in 148 cattle herds in 1994. The predominant serovars were *S. Dublin* (62%) and *S. Typhimurium* (35%) (Table 5.2).

At cattle slaughterhouses a total of approx. 250 samples are collected at random each month from a representative sample of the beef cuts and the offal. The number of positive samples has been constantly low (mean 0.4%) all through 1994. The distribution of predominant serotypes reflects the distribution of serotypes found in the cattle herds as causes of clinical salmonellosis.

At the retail level the number of *Salmonella* positive samples in beef has increased compared to the slaughterhouse control, and the serotype distribution does not entirely reflect the distribution in the herds and at slaughter. This indicates that cross contamination from other meat products (most likely pork) has taken place during cutting and processing of beef at retail outlets.

A screening for *Listeria monocytogenes* in products of beef at the retail level was performed in 1994. The results are shown in Table 4.

A total of 1,093 samples of milk and milk products were examined for *Salmonella* in 1994, all with negative results. A total of 1,792 samples of milk and milk based products were investigated for *Listeria*. *L. monocytogenes* was detected in 2 samples, one sample of unripe cheese and one sample of butter.

Other zoonotic pathogens, notably *Campylobacter* have not been investigated in 1994. A survey for *Campylobacter* in samples of beef at retail outlets will be carried out during 1995.

5. Salmonellosis as a notifiable animal disease (4)

Although some outbreaks of salmonellosis may be of big economic significance for the individual herd, the general economic importance of the disease to farmers is negligible, despite the fact that *Salmonella* is endemic in most segments of the animal industry. The reported cases of salmonellosis in pigs and cattle for the past 5 years are shown in Table 5.1 and 5.2, respectively.

The tables give the number of isolations of *Salmonella* in material from clinically affected animals submitted for laboratory examination.

Furthermore, a few trends concerning clinical salmonellosis in animals have been noted:

a) Cattle

The number of cases associated with *S. Dublin* is decreasing, whereas *S. Typhimurium* remains constant. It is the experience that there is a marked seasonal pattern, with a distinct peak in late summer and early autumn.

b) Pigs

Clinical salmonellosis in pigs is a recent phenomenon. 10 years ago it was virtually unknown. In 1993 revised regulations came into force, imposing certain restrictions on herds with clinical salmonellosis. It is not possible to determine with certainty whether the decline in the number of registered cases from 1992 to 1993 reflects a true decrease in the incidence of salmonellosis or a change in the reporting practice.

c) Poultry

Outbreaks of salmonellosis in the poultry industry are very rare.

Table 4. Occurrence of zoonotic pathogens in cattle and beef

Category	Zoonosis	Agent	Herd level			Slaughterhouse				Retail				Note
			Examined		% positive herds	Cuts of beef		Offal		Not heat treated		Heat treated		
			Herds	Animals		N	% positive samples	N	% positive samples	N	% positive samples	N	% positive Samples	
I	Tuberculosis	<i>M. bovis</i>	0	0	0	All	0	All	0		0		0	a
	Brucellosis	<i>B. abortus</i>			0									b
	Salmonellosis	<i>Salmonella spp.</i>	0	0		1838	0.44	1715	0.41	2217	0.81	2615	0.11	
		<i>S. Enteritidis</i>	0	0			0.11		0		0		0	
		<i>S. Typhimurium</i>	0	0			0.22		0.12		0.32		0.08	
		<i>S. Dublin</i>	0	0			0.11		0.23		0.09		0	
	<i>Other serotypes</i>	0	0			0.05		0.06		0.41		0.04		
II	Campylobacteriosis	<i>C. coli/jejuni</i>	0	0		0		0		0		0		
		<i>L. monocytogenes</i>	0	0		0		0		65	29	10	0	

Notes:

- Bulls at AI stations are examined by TB test. Notifiable disease. No cases diagnosed. One case in a herd of farmed deer registered in 1994.
- Bulls examined on admission to AI stations. Clusters of abortion notifiable. Notifiable disease in cattle. No cases diagnosed.

Table 5.1. Pigs: Isolations of Salmonella in material from outbreaks of clinical disease

Type	No. 1994	No. 1993	No. 1992	No. 1991	No. 1990
Typhimurium	83	91	112	42	18
Infantis	2	10	4	1	2
Derby		6	4		
Berta		1			1
Hadar	1			1	
Dublin				1	
Havana					1
Orion			1		1
Tacksony					1
16:d:-		1	1		
4.12:b:-	3	7	14	4	4
b. 12:6-			1	1	
Worthington		2	2	3	
Falkensee			1		
Agona		1	1		
Anatum			2		
Mbandaka	1	2	2		
Panama	2				
Heidelberg	1				
Livingstone	2	2			
Ohig		1			
Saint paul		1			
Meleagridis	1				
Typhimurium/Infantis		1			
Typhimurium/Ohio			1		
Typhimurium/Bredeney					1
Total	96	127	146	54	30

Table 5.2. Cattle: Isolations of Salmonella in material from outbreaks of clinical disease

Type	No. 1994	No. 1993	No. 1992	No. 1991	No. 1990
Dublin	92	71	143	167	224
Typhimurium	52	46	64	46	54
Enteritidis	2	5	2	8	9
Infantis		3		3	1
Thompson					1
Berta					3
Hadar			1	1	1
Kentucky					1
Senftenberg				1	1
4.12:b:-				3	1
Ona					1
Oakland					1
Dublin/Mbandaka					1
Ruiru				1	
Agona				1	
London				2	
Mbandaka			1	1	
Montevideo			1	2	
Agona/Typhimurium				1	
Y:1,5				1	
Farmsen			1	1	
Tennessee			1	1	
Give				1	
Ohio			1		
Enteritidis/4.12:b:-			1		
Typhimurium/Tennessee		1			
Havanna		1			
Vejle	1				
Total	148	128	216	244	299

6. Zoonoses in humans (6.3, 6.4)

The annual number of registered cases of human salmonellosis caused by zoonotic Salmonella serotypes has increased over the last decade, reaching a maximum of 4,276 cases in 1994 (82.3 cases per 100,000 inhab.). It is estimated that approx. 85% of the cases are domestic, whereas the remaining 15% may have been contracted while travelling abroad. The predominant serotypes were S. Enteritidis (1,876 cases) and S. Typhimurium (1,363 cases), whereas the remaining cases were distributed among approximately 100 different serotypes (Table 6.1). S. Sandiego (236 cases), S. Newport (140 cases) and S. Hadar (133 cases) predominated among the serotypes of minor importance in 1994.

In 1994, a relatively large increase of the number of infections caused by S. Enteritidis was observed compared to 1993. Epidemiological investigations primarily based on epidemiological typing of bacterial isolates and investigations of outbreaks have pointed to the consumption of contaminated table eggs as the major source of this increase.

During 1994, human and veterinary isolates of Salmonella were continuously compared by different epidemiological typing methods such as phage typing and DNA fingerprinting. This made it possible to estimate the significance of different animal products as sources of human salmonellosis in Denmark in 1994 (Table 6.2).

An increasing number of infections with S. Sandiego has been observed. The sources of these infections have remained obscure. The majority of cases occur in young children between 6 months and 5 years of age, but cases are observed in all age groups and scattered around the country. In 1995, a case control study will be initiated to trace specific risk factors associated with contracting S. Sandiego infection.

The number of registered cases of campylobacteriosis increased from 1992 to 1993 and increased further in 1994. The reasons for this increase are not known.

The number of registered cases of yersiniosis has shown a decreasing trend since 1985. The reasons for these changes are not known.

Two epidemics of listeriosis have been recorded in Denmark in 1986 and in 1990. Epidemiological typing of *Listeria monocytogenes* from cases of human listeriosis in 1994 have indicated that infections this year were sporadic and probably contracted from various sources.

Only in the case of outbreaks of probable food-borne intestinal disease (two or more cases associated with the same potential source of infection), the Municipal Food Inspection Units will be requested to identify a potential common source of infection. In 1994, 13 outbreaks comprising a total of 86 patients were investigated. The results of these investigations indicated that eggs were the most important source of zoonotic foodborne outbreaks in 1994 (9 outbreaks), and that the infectious agent was *S. Enteritidis* in eight of these cases (Table 6.3).

Table 6.1. Zoonoses in humans, 1994 - incidence and trends of 5 and 10 years

Category	Zoonosis	Agent	1994		Five years trend					10 years	Note:	
			Cases per 100.00 inh.	Registered cases	1993	1992	1991	1990	1989			1984
I	Tuberculosis	<i>M. bovis</i>	0.06	3	3							a
	Brucellosis	<i>B. abortus/melitensis</i>	0	0	0	0	0	0	0	0	0	b
	Trichinosis	<i>T. spiralis/nativa</i>	0	0	0	0	0	0	0	0	0	c
	Salmonellosis	<i>Salmonella spp.</i>	82.3	4276	3802	3379	2238	2112	2626	933	d	
		<i>S. Enteritidis</i>	36.1	1876	1093	1511	1013	562	689	369		
<i>S. Typhimurium</i>		26.2	1363	1193	1289	705	728	1044	286			
	<i>Other serotypes</i>	20.0	1037	1516	579	520	822	893	278			
II	Campylobacteriosis	<i>C. coli/jejuni</i>	42.3	2196	1776	1129	1261	1367	1432	1462		
	Echinococcosis	<i>E. multilocularis/granulosus</i>	0	0	0	0	0	0	0	0	e	
	Listeriosis	<i>L. monocytogenes</i>	0.4	23	27	24	32	37	32	8	f	
	Rabies		0.0	0	0	0	0	0	0	0	g	
	Toxoplasmosis	<i>T. gondii</i>	0	0	0	0	0	0	0	0	h	
	Yersiniosis	<i>Y. enterocolitica</i>	12.4	643	710	901	929	967	879	989		
	Coll infections	<i>E. coli</i>	0.7	35	28	33	49	32	49	84		
		<i>O157</i>	0.04	2	1	3	6	2	0	0		

Notes:

- a Notification not mandatory. No domestically acquired cases, but few imported cases occur.
 b Notification not mandatory. No domestically acquired cases, but few imported cases occur.
 c Notification not mandatory. No domestically acquired cases, but few imported cases occur. (Notification mandatory until 31 December 1993).
 d Only first isolations registered.
 e Notification not mandatory. A few imported cases occur.
 f Notification mandatory from 1986.
 g Notification not mandatory. No domestically acquired cases.
 h Notification not mandatory. Sero prevalence in Danish humans approx. equal to the mean age of the population.

Table 6.2. Estimated primary sources of human salmonellosis as indicated by epidemiological investigations

Primary source	No. of cases	% cases
Pigs	650	15
Poultry	850	20
Eggs	1100	26
Travels	600	14
Unknown	1100	26

Table 6.3. Registered outbreaks of food-borne zoonotic disease.

Zoonotic agent	No. patients involved	Suspected source	Confirmed by culture
<i>C. jejuni</i>	8	Beef	No
<i>Salmonella spp. a)</i>	2	Beef	No
<i>S. Hadar</i>	8	Turkey	No
do.	8	Egg	No
<i>S. Enteritidis</i>	12	Chicken	No
do.	4	Egg	Yes
do.	8	Egg	Yes
do.	2	Egg/beef	(Yes)
do.	18	Egg	No
do.	4	Egg	Yes
do.	5	Egg	No
do.	4	Egg	No
do.	3	Egg	No

a) Serotype not reported