National Food Institute

Technical University of Denmark DTU

Annual Report on Zoonoses in Denmark 2006

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Zoonoses in Denmark 2006

Edited by:
Birgitte Helwigh and Tine Hald
The Danish Zoonosis Centre

Steen Ethelberg
The Statens Serum Institut

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Reprints can be ordered from:
The Danish Zoonosis Centre
The National Food Institute
Mørkhøj Bygade 19
DK - 2860 Søborg
Denmark
Phone: +45 72 34 70 84
Fax: +45 72 34 70 28
E-mail: dzc@dzc.dk

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Contents

Introduction

The Annual Report on Zoonoses presents a summary of the trends and sources of zoonotic infections in humans and animals, as well as the occurrence of zoonotic agents in food and feeding stuffs in Denmark in 2006. Greenland and The Faeroe Islands are not presented. The report is based on data compiled according to the Zoonoses Directive 03/99/EEC, supplemented by data obtained from national surveillance and control programmes as well as data from relevant research projects provided by institutions contributing to the report. For the first time, information concerning Q-fever is included in the report.

Occasionally corrections to the data may occur after publication resulting in minor changes in the following years reports. The report is also available at www.food.dtu.dk.

Profile of the year

Overall, the total number of human cases decreased by 10% in 2006 compared to 2005. The reduction was recorded for all pathogens except for *Salmonella* serotypes other than S. Typhimurium and S. Enteritidis. The largest decrease was seen for *Campylobacter*. In total, 3,227 cases were recorded representing a 12% reduction. A total of 1,658 *Salmonella* cases was reported, corresponding to a 7% decrease compared to 2005. The decrease can partly be explained by the reduction in estimated number of human cases due to Danish produced foods. In 2006, 15% of the human cases was estimated to be due to Danish food products, compared to 30% in 2005. The reduction is mainly observed in human cases caused by Danish pork, table eggs and broiler meat. Imported food products were assessed to be the cause of infection in 18% of the human cases, which is similar to previous years. However, the distribution of human cases caused by imported products changed conciderable. and imported turkey meat was estimated to be the source of five times as many human cases in 2006 compared to 2005.

Outbreaks

Similar to last year, norovirus was the agent causing most outbreaks. Several of these involved infectious food-handlers contaminating the food in restaurant or canteen settings.

As in previous years *Salmonella* was the bacterial agent responsible for most outbreaks, and S. Typhimurium outbreaks were detected more frequently than outbreaks caused by S. Enteritidis.

The largest enterotoxigenic *E. coli* (ETEC) outbreak reported in Denmark to date involved 217 cases at a high school party. A cohort study pointed towards a contaminated basil used in a pesto as the vehicle. An outbreak with *Campylobacter* at a company with 130 employees involved 23 probable cases. Investigations indicated cross-contamination of a relish from chicken meat juice in the canteen kitchen. A foodborne group A Streptococcus outbreak among approx 1,000 employees attending the same canteen involved at least 200 persons. A cold pasta salad served on a specific date was pointed out as the probable source. The pasta was probably contaminated by the chef.

Surveillance

The surveillance programme for multi-drug resistant S. Typhimurium DT104 (MRDT104) was changed in November 2006 and is now a part of an intensified control for *Salmonella* and *Campylobacter* in Danish and imported meat.

The EU regulation 183/2005 on feed hygiene came into force in January 2006. After which the Danish Plant Directorate increased the focus of the control of the feed business operators and reduced the microbiological control of the feed.

The EU Regulation 2073/2005 on microbiological criteria for foodstuffs came into force in January 2006 introducing harmonised criteria for microbiological agents in food.

EU Regulation 2075/2005 on official controls for *Trichinella* in meat came into force in 2006. The regulation made it possible for the Member States to apply for status as region with negligible risk of trichinosis among pigs. Denmark has submitted an application.

Overviews of the different surveillance programmes for poultry, pigs and cattle are presented in the Appendix Tables A21-A24.

1 Surveillance and outbreak investigations

1.1 Surveillance of human diseases

Described in this report, are the Danish occurrence of zoonotic enteric pathogens:

- notifiable through the laboratory surveillance system: *Salmonella, Campylobacter, Yersinia,* Verocytotoxin-producing *E. coli* and *Listeria,*
- individually notifiable zoonotic pathogens: *Chlamydia psittacci* (ornithosis), *Leptospira, Mycobacterium,* BSE prions (var. Creutzfeldt-Jakob Disease), Verocytotoxin-producing *E. coli* and *Lyssavirus* (rabies),
- non-notifiable zoonotic pathogens: *Brucella, Coxiella burnetii* (Q-fever), *Cryptosporidium, Echinococcus, Toxoplasma* and *Trichinella*.

An overview of these notifiable and non-notifiable human diseases with reference to the relevant legislation is provided in Table A21.

In Denmark, the physicians report individually notifiable zoonotic diseases to the medical officers and the Department of Epidemiology at the Statens Serum Institut (SSI) (Figure 1). Positive cases diagnosed by a clinical microbiological laboratory are reported through the laboratory surveillance system to the Unit of Gastrointestinal Infections at the SSI. Physicians send specimens from suspect cases to one of 15 clinical microbiology laboratories depending on county of residence of the requesting physician. The laboratories must report positive results to the SSI within one week. Furthermore, all *Salmonella* and VTEC isolates are sent to the reference laboratory at the SSI for further typing. The results are recorded in the Register of Enteric Pathogens maintained by the SSI. Positive cases are reported as episodes, i.e. each person-infectious agent combination is only recorded once in any six-month period.

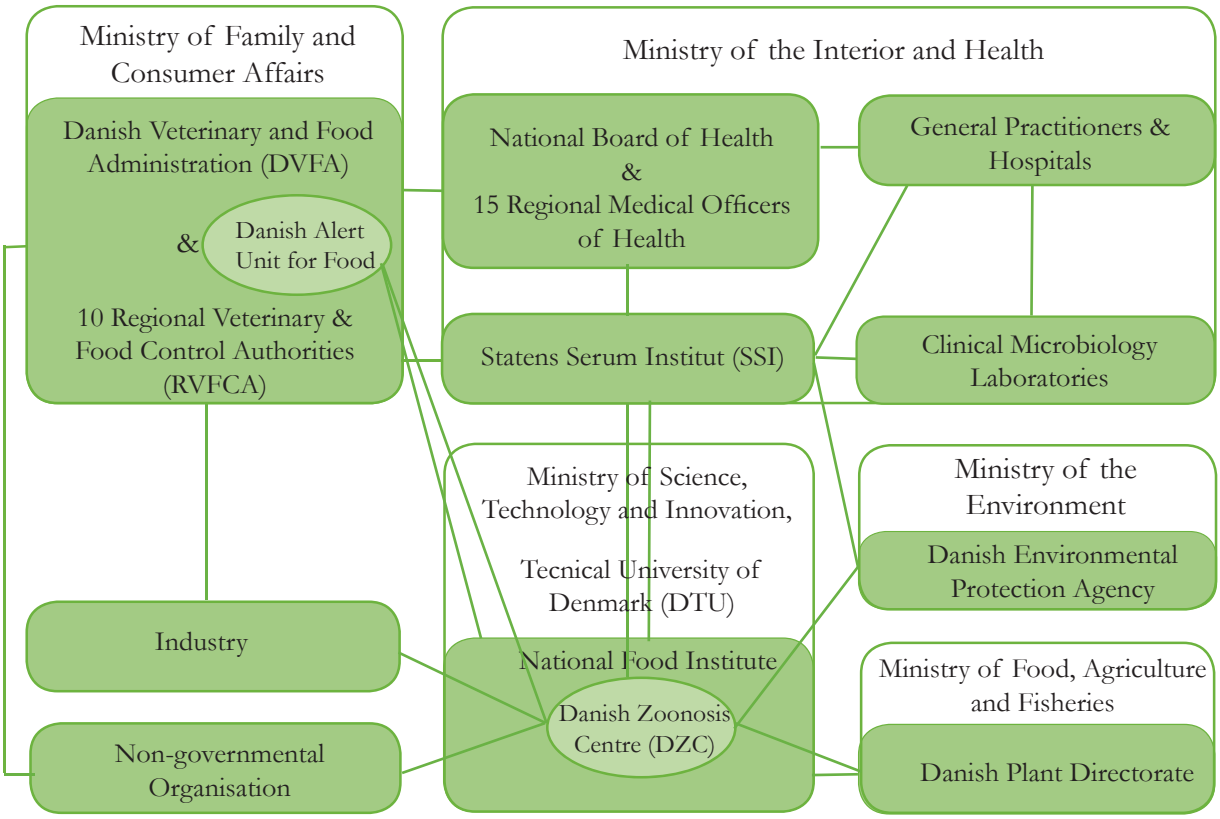


Figure 1. Overview of the monitoring and outbreak investigation network for reporting infectious pathogens in humans, animals and feedstuffs in Denmark. From January 1st 2007, the DZC became a part of the National Food Institute DTU.

Source: DZC

1.2 Outbreaks of zoonotic gastrointestinal infections

In Denmark, local foodborne outbreaks are typically investigated by the Regional Veterinary and Food Control Authority (RVFCA) in collaboration with the medical officer; often with the participation of the regional clinical microbiology laboratory. Larger outbreaks involving more than one region are typically investigated by the SSI, the National Food Institute, and the Danish Veterinary and Food Administration (DVFA). These institutions may also aid in the investigation of local outbreaks. In 2006, a new Danish Alert Unit for Food was established at the DVFA (see box for further description) and in 2006 this unit co-ordinated the day-to-day collaboration between the National Food Institute, the SSI and the DVFA. Representatives from these institutions meet regularly to discuss surveillance results, compare the reported occurrence of zoonotic agents in animals, food and feedstuffs with that in humans, and review major outbreaks. The formal responsibility of investigating food- or waterborne outbreaks is currently divided between three ministries based on the outbreak source: the Ministry for the Interior and Health for infectious diseases; the Ministry of Family and Consumer Affairs for food and animal related diseases; and the Ministry of the Environment (along with the municipality) for water related diseases.

Outbreaks may be detected in various ways, e.g. individuals who experience illness related to food intake in settings such as restaurants or work place cantinas may report these incidents directly to the RVFCA. Physicians are obligated to report all suspect water- and foodborne infections to the regional medical officer and to the SSI. Clusters of cases may be noted in the laboratory or identified at the SSI through the laboratory surveillance system of gastrointestinal bacterial infections or though subtyping of bacterial isolates from patients.

Outbreaks are reported in the Food- and waterborne outbreaks database (FUD) which was introduced towards the end of 2005. Based on

Danish Alert Unit for Food

To secure unambiguous and coordinated instructions concerning the handling of food crises it is necessary to gather an overall picture of the situation as well as to perform creative thinking to produce the best solutions. This is one of the main reasons for the establishment of The Danish Alert Unit for Food in 2006 at The Danish Veterinary and Food Administration.

The purpose with the establishment of the unit is furthermore to place the responsibility at one place, establish one channel of commands and thus secure a coordinated, effective and quick handling of food crises nationally and internationally.

Tasks:

- Coordination of the work with food borne outbreaks both national and regional
- Withdrawals and recalls of products not in compliance with the food safety requirements
- Contingency plans for food and for civil preparedness in the Danish Veterinary and Food Administration
- Early warnings of the public in emergency situations
- Civil emergency response and early warnings
- The Alert Food hot line for acute queries outside normal opening hours
- Contact Point of the EU Rapid Alert System for Food and Feed
- Chair in Central Crisis Management Group for food borne diseases
- Education and practice in preparedness planning
- Cooperation with other authorities in crises

The unit mainly has competences concerning coordinating and procedural issues in food crises situations. The professional knowledge in each case is still placed in other offices in the Danish Veterinary and Food Administration.

Table 1. Foodborne disease outbreaks reported in the Foodborne Outbreak Database (FUD), 2006

Pathogen	No. of patients	Patients laboratory confirmed	Setting	Suspected source	FUD no.
Lectins (beans)	10	0	Canteen	Fresh vegetables	627
Histamin	4	0	Unknown	Fish	669
Norovirus	36	0	Food producer	Molluscs, shellfish, etc	544
Norovirus	43	0	Hotel	Composite meal	616
Norovirus	21	0	Hotel	Unknown	677
Norovirus	22	0	Private party	Composite meal	571
Norovirus	23	2	Restaurant or sim.	Unknown	554
Norovirus	150	7	Restaurant or sim.	Unknown	467
Norovirus	12	1	Private home	Unknown	595
Norovirus	25	6	Canteen	Confectionary products	568
Norovirus	27	6	Restaurant or sim.	Molluscs, shellfish, etc	470
Norovirus	32	0	Private home	Buffet meals	674
Norovirus	20	0	Private home	Buffet meals	673
Norovirus	18	0	Private home	Fresh vegetables	671
Norovirus	125	0	Canteen	Other foods	663
Norovirus	18	3	Restaurant or sim.	Unknown	660
Norovirus	7	1	Restaurant or sim.	Other foods	659
Norovirus	35	1	Private party	Fresh vegetables	638
Norovirus	5	2	Shop	Other foods	553
Norovirus	9	2	Restaurant or sim.	Unknown	643
Streptococcus	36	21	Private party	Other foods	667
Streptococcus	200	18	Canteen	Buffet meals	624
S. O:4,5,12,H:i:-	5	5	Unknown	Unknown	631
S. O:4,5,12,H:B:-		6	Unknown	Unknown	623
S. Typhimurium	6	6	Shop	Unknown	530
S. Typhimurium	4	3	Unknown	Unknown	629
S. Typhimurium	6	6	Shop	Pork	683
S. Typhimurium	36	36	Restaurant or sim.	Composite meal	622
S. Typhimurium	10	10	Shop	Pork	687
S. Typhimurium		15	Unknown	Unknown	664
S. Typhimurium		24	Food producer	Pork	637
S. Typhimurium	6	6	Unknown	Pork	607
S. Kottbus	5	4	Other	Unknown	630
S. Java		7	Unknown	Unknown	645
S. Enteritidis	8	7	Restaurant or sim.	Buffet meals	594
S. Enteritidis	6	1	Institution	Eggs	456
S. Newport	45	9	Hotel	Buffet meals	611
VTEC		2	Institution	Unknown	596
ETEC	250	21	School	Herbs and spices	661
Escherichia coli	10		Restaurant or sim.	Composite meal	678
Clostridium perfringens	30	0	Canteen	Composite meal	676
Clostridium perfringens	13	0	Private party	Beef	613
Clostridium perfringens	12	0	Restaurant or sim.	Buffet meals	666
Clostridium perfringens	17	0	Canteen	Beef	665
Clostridium perfringens	62	0	Food producer	Composite meal	543
Campylobacter	11	1	Restaurant or sim.	Unknown	670
Campylobacter	23	6	Canteen	Buffet meals	614
Bacillus cereus	2	0	Restaurant or sim.	Buffet meals	672
Unknown	13	0	Restaurant or sim.	Pork	639
Unknown	2	0	Restaurant or sim.	Composite meal	642
TOTAL	1460	245			

these data, Table 1 lists outbreaks investigated in 2006. Household outbreaks and outbreaks that were reported but not investigated to the extent of providing reliable detailed information are not included. Similar to last year, norovirus was the agent causing most outbreaks (Figure 2). Several of these involved infectious food-handlers that contaminated the food in restaurant or canteen settings. These outbreaks are not mentioned further in this report. Some of the other more notable outbreaks are outlined below.

In November, a large outbreak took place among the approx. 750 students and teachers attending a high school party (FUD no. 661). In total, 58% of at-

tendants responded to the conducted cohort study and 50% (250 individuals) was probable cases. Diarrhoea was reported by 95% and vomiting by 31% of the cases; 80% had onset of symptoms within 24 hours of the party dinner. Faeces samples from 48 patients were analysed; enterotoxigenic *E. coli* (ETEC) were found in 18 patients and S. Anatum in 4. The cohort study pointed towards pesto served with pasta at the dinner. S. Anatum and *E. coli*, though not the ETEC types found in patients, were isolated from leftovers of the pesto. The bacteria were probably introduced via imported basil used in the pesto. In Denmark, ETEC is normally seen as travel-diarrhoea and this outbreak is the largest ETEC outbreak described so far.

Large outbreaks with *Campylobacter* are rare, but in 2006, one outbreak was reported in a company with 130 employees (FUD no 614). There were 23 probable cases and 6 were culture confirmed. A cohort study pointed towards a relish served with fish and chips in the company canteen as the vehicle of infection. Investigations in the canteen kitchen subsequently revealed that raw pieces of chicken had been thawed in a refrigerator where the relish was also kept and that meat juice had dripped into the relish.

A foodborne group A *streptococcus* outbreak was also investigated in 2006 (FUD no 624). This outbreak took place among the approx. 1,000 employees working in the same office building housing several companies which were all served by the same canteen. Eighteen patients were found positive for group A streptococci by rapid test, but at least 200 persons had compatible throat symptoms. A retrospective cohort study was performed among employees of the two largest companies. It indicated cold pasta served in the shared office building canteen at a specific date as the probable source of the outbreak. Group A streptococci isolates cultured from three patients and from the chef who had prepared the pasta displayed identical PFGE patterns, M- and T- types. The pasta was probably contaminated by the chef.

As in previous years *Salmonella* was the bacterial agent responsible for most outbreaks, and S. Typhimurium outbreaks were detected more frequently than outbreaks caused by S. Enteritidis. The fact that a routine real-time subtyping by MLVA typing was applied to S. Typhimurium and not to S. Enteritidis might explain that more S. Typhimurium outbreaks were detected.

In one outbreak (FUD no. 637) caused by S. Typhimurium DT120, patients was identified by the laboratory surveillance, but occurred predominantly in one part of the country. In this outbreak comparison of patient isolates with isolates obtained from the *Salmonella*-surveillance at farm level and at slaughterhouses identified a specific local slaughterhouse and furthermore a few specific pig herds as the likely source of the outbreak. This led to closure of the slaughterhouse for several weeks, during which the slaughterhouse was thoroughly cleaned. The same slaughterhouse was implicated in an outbreak mentioned in the 2004 Annual Report (FUD no. 361). In both outbreaks typing by MLVA played an important role in detecting and pointing at the possible source of the outbreaks. A second outbreak caused by S. Typhimurium DT104 (FUD no 622), involved 36 laboratory confirmed patients of which 32 had eaten at the same restau-

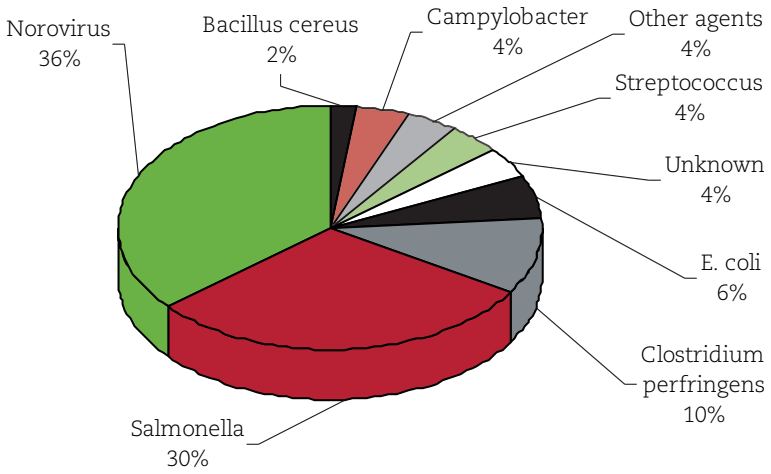


Figure 2. Aetiology of foodborne disease outbreaks reported with a causative agent in the Foodborne Outbreak Database (FUD), 2006.
Source: DZC

rant. At the restaurant, the outbreak strain was isolated from lettuce, which was believed to have been cross-contaminated in the restaurant kitchen.

1.3 Surveillance of zoonotic agents in animals and animal products

In Denmark, *Salmonella* monitoring and surveillance programmes have been implemented for all major food animals and food of animal origin. Samples are collected from farms, slaughterhouses and at retail outlets. Monitoring programmes for poultry, pigs and cattle are presented in Tables A22-A24. Sample analysis is performed at authorised private laboratories, the RVFCA or the National Food Institute. Results are reported in central databases. In addition, *Salmonella* isolates are forwarded to the National Food Institute for subtyping (serotyping, phage typing and antimicrobial susceptibility testing).

The Danish surveillance programme for multidrug resistant S. Typhimurium DT104 (MRDT104) has been in place since 1998. The programme mandates a zero-tolerance for this pathogen in all foods. Meat imported from 3rd countries and the EU is randomly collected and tested for *Salmonella*. Sample analysis is performed at the RVFCA. If MRDT104 is detected the batch is rejected or heat-treated. In November 2006 the sampling plan for this programme was changed and the programme is now a part of the project on intensified control for *Salmonella* and *Campylobacter* in Danish and imported meat (described in the textbox, page 10).

An intervention strategy aiming at reducing the number of *Campylobacter* positive broiler flocks was initiated in 2003. The strategy is voluntary and no regulations have been prepared. All broiler flocks are sampled for *Campylobacter* at the slaughterhouse prior to slaughter, and the samples are analysed at the National Veterinary Institute or at the slaughterhouse using a PCR detection method.

Pigs and cattle carcasses are screened for *Mycobacterium* and *Echinococcus* during meat inspection at the slaughterhouse. All slaughter pigs slaughtered at export approved slaughterhouses, all horses slaughtered for human consumption and all wild boars are examined for *Trichinella*.

In addition, boars and bulls are tested for *Brucella* and *Mycobacterium* (only in bulls) at semen collection centres. All positive results for notifiable infectious diseases are reported to the DVFA. Surveillance for BSE in cattle and TSE in sheep/goats is outlined in Tables A17 and A18.

An overview of notifiable and non-notifiable zoonoses described in this report, are presented in Table A21 along with the relevant legislation.

Salmonella Typhimurium DT193 – four outbreaks in Northern Jutland

During the last year, a specific epitype of S. Typhimurium DT193 was found in three clusters of salmonellosis amongst humans and one amongst cattle herds.

In October 2005, 17 human cases of salmonellosis were reported. All patients except one resided in the same area in Northern Jutland. Investigations pointed to a local butcher shop as the source of infection. From November 2005 to January 2006 a cluster with 13 human cases of salmonellosis was found. No single source of infection was found. From June 2006 and the following three months another cluster of eight human cases was detected.

In September and October cases of salmonellosis appeared in cattle herds located in a distinct area between the towns Løgstør and Farsø, Northern Jutland. The epitype was identical with the epitype found in the human clusters. In most of the affected farms the clinical symptoms were severe. One of the human cases had close contact to an infected farm. At the same time this specific epitype was found in a poultry flock and in two pig herds without clinical symptoms.

A serological screening programme was organized, because it was suspected that the infection was spreading between the cattle farms. Tank milk samples from all milk producing farms inside and around the area of interest were tested. Veterinary officers visited all serological positive farms and samples were taken for bacteriological examination. None of the farms had animals with clinical symptoms and the pathogen was not detected in any of the samples.

Since December 2006, no new cases amongst humans or herds have occurred.

Intensified control of *Campylobacter* and *Salmonella* in fresh meat – case-by-case based risk assesment

Background

A new programme for control of *Salmonella* and Campylobacter in Danish and imported fresh meat was imposed in November 2006. Pork and beef are tested for *Salmonella* and poultry meat is tested for both *Salmonella* and *Campylobacter*. *Salmonella* isolates are serotyped and tested for antimicrobial resistance; S. Typhimurium and S. Enteritidis positive isolates are phage typed.

If a positive batch is encounted, the RVFCA request the National Food Institute to conduct a risk assessment, where the estimated prevalence and relative human risk is compared to the general level in 2005. For *Salmonella*, the relative human risk estimate is based on a Human Illness Attribution Model from 2005 (se section 2.2 for description). For *Campylobacter*, the estimated relative human risk is based on a mathematical model developed for a risk assessment on *Campylobacter* in chicken products in 2001. This model includes the quantitative test results i.e. cfu/g.

Based on the risk assessment, the local RVFCA departments decide if the specific batch of fresh meat must be considered injurious to human health according to article 14 in the EU Food Law. If so, the food producing establishments cannot market the batch and already marketed batches must be withdrawn. A Rapid Alert notification is issued to the EU commission if the incriminated batch has been traded across borders.

Results

From November 2006 to January 2007 the control programme was carried out as a pilot project. In total, 89 batches of imported meat and 49 batches of Danish meat were tested. A total of 32 risk assessments were conducted; 28 batches were positive for *Salmonella* or *Campylobacter*, four batches were positive for both pathogens. The findings are presented in Table I.

Table I. Results from the intensified control of* Campylobacter *and* Salmonella *in fresh meat based on a case-by-case surveillance, 2006

		No. of batches tested	No. of batches positive	No. of batches sanctioned	Mean prevalence in positive batches	Mean relative human risk in positive batches
Campylobacter						
Danish	Poultry	17	1		8.30%	0.5
Imported	Poultry	52	16	4[a]	32.30%	4.0
Salmonella						
Danish	Beef	14	0			
	Pork	18	0			
	Poultry	17	0			
Imported	Beef	5	0			
	Pork	32	8	1[b]	2.80%	4.6
	Poultry	52	7	3[c]	19.70%	4.0

[a] Four batches from France sanctioned.

[b] One batch from Germany sanctioned.

[c] One batch from Poland, France, the Netherlands and Germany, respectively, sanctioned.

Source: DVFA

Overall, 6% of the Danish batches of fresh poultry meat tested *Campylobacter* positive compared to 31% of the imported batches. No Danish batches were found *Salmonella* positive, whereas *Salmonella* was detected in 17% of the imported batches of fresh meat. In imported batches positive for *Salmonella* 60% were multiresistant (9 batches) and 27% were resistant to fluorquinolone (4 batches). Nine batches were sanctioned due to unacceptable contamination with *Salmonella* (5 batches) or *Campylobacter* (4 batches). Approximately 2.7 tons of contaminated meat was withdrawn from the market.

1.4 Official testing of zoonotic pathogens in foodstuffs

The EU Regulation 2073/2005 on microbiological criteria for foodstuffs came into force in January 2006, introducing harmonised criteria for microbiological agents.

Monitoring for zoonotic pathogens in foodstuffs is coordinated both at the regional and at the central level of administration. Each RVFCA is responsible for the control carried out within its own region, and the DVFA is responsible for the regulation, control strategy and the surveillance at the national level.

The main purpose of the regional microbiological control system is to verify that the own-check programmes implemented at food establishments are functioning effectively and to verify the compliance with the microbiological criteria laid down in the legislation.

Regional microbiological control is carried out as follows:

- Targeted survey sampling primarily at the retail level. These surveys are focused on collecting samples from high risk products, specific types of production processes or specific types of food establishments,
- Other types of sampling at the food whole sale and retail level includes:
  * sampling based on suspicion to support findings from inspection of food establishments,
  * sampling at the wholesale level to verify compliance with microbiological criteria in the legislation,
  * sampling in relation to the investigation of food-borne outbreaks,
  * sampling in response to consumer complaints.

Centrally co-ordinated control is carried out as national projects or surveys. The purposes of these projects are to:

- Verify compliance with microbiological criteria laid down in the legislation,
- Discover emerging problems with microbiological contaminants,
- Generate data for the preparation of risk profiles and risk assessments to support microbial risk management,
- Monitor the effect of established risk management procedures in order to evaluate if these provide the desired results or if they need to be reconsidered.

Table 2 provides information on the centrally co-ordinated projects conducted in 2006. Some projects are described in more detail later in the report. For further information consult DVFA's webpage www.fvst.dk (in Danish). The findings of *Salmonella* and *Campylobacter* in non-heat treated meat cuts from broiler, turkey, pork and beef products are presented in (Tables A6-A9, A11).

Table 2. Centrally coordinated studies conducted in 2006.

Title of project	No. of samples	Agents analysis per sample (regional laboratories)	Futher information
Microbiological classification of the production areas for bivalve molluscs	100	*E. coli, Salmonella*	Results were not available as we go to press
Campylobacter and antimicrobial resistance in fresh, chilled Danish chicken meat	1,000	*Campylobacter, Salmonella, E. coli, Enterococcus*	Section 3.2
Campylobacter and antimicrobial resistance in fresh chilled and frozen imported chicken meat and frozen Danish chicken meat	1,800	*Campylobacter, Salmonella, E. coli, Enterococcus*	Section 3.2
Campylobacter and antimicrobial resistance in fresh chilled imported turkey meat	600	*Campylobacter, Salmonella, E. coli, Enterococcus*	Section 3.2
Salmonella and *Yersinia* enterocolitica O3 in cuts of fresh chilled pork from the retail sector	1,000	*Salmonella (semiquantitative), Yersinia enterocolitica O3*	Results were not available as we go to press
VTEC in cattle	700	*VTEC*	Section 6.2
VTEC in fresh imported beef	330	*E. coli O26, O103, O111, O145, O157*	Section 6.3
Salmonella in minced meat	700	*Salmonella*	Results were not available as we go to press
Multiresistent *Salmonella* Typhimurium DT104 in imported meat	3,428[a]	*Salmonella*	Section 2.6
Intensified control for *Salmonella* and *Campylobacter* in fresh Danish meat	792[b]	*Salmonella, Campylobacter(quantitative)*	Section 1.3 (text box)
Intensified control for *Salmonella* and *Campylobacter* in fresh imported meat	1,692[c]	*Salmonella, Campylobacter(quantitative)*	Section 1.3 (text box)
Salmonella, Campylobacter and E. coli in frozen imported berries	500	*Salmonella, Campylobacter, E. coli*	Results were not available as we go to press
Salmonella and *Campylobacter* in imported herbs from South-East Asia	500	*Salmonella, Campylobacter*	Results were not available as we go to press
Salmonella and *Campylobacter* in lettuce	500	*Salmonella, Campylobacter*	Results were not available as we go to press
Microbiological control of the production of Danish sausages	150	Aerobic colony count, *Lactobacillae*	Results were not available as we go to press

[a] Samples representing 687 batches

[b] Analyses representing 44 batches

[c] Analyses representing 87 batches

Source: DVFA and National Food Institute, DTU

2. Salmonella

2.1 *Salmonella* in humans

The number of human *Salmonella* infections in Denmark began to increase in the mid 80's. During the following years, three distinct waves of salmonellosis related to the consumption of Danish produced broiler meat (peaking in 1988), pork (peaking in 1994) and table eggs (peaking in 1997) were observed. Since 1997, there has been a steadily decreasing trend (Figure 3). The reduction of human cases is to a large extent attributed to the large-scale national efforts aimed at reducing the occurrence of Salmonella in broilers, pigs and table-egg layers produced in Denmark.

In 2006, 1,658 laboratory-confirmed episodes of salmonellosis were reported corresponding to 30.5 cases per 100,000 inhabitants (Table A1). This represents an increase of 8% in the number of infections compared to 2004, and a decrease of 7% compared to 2005. Overall, the number of infections with S. Enteritidis and S. Typhimurium has been stable for the past three years.

In 2006, there were 562 reported episodes of S. Enteritidis corresponding to an incidence of 10.3 per 100,000 (Table A1). This represents a 12% decrease compared to 2005. Figure 4 shows the geographical distribution of S. Enteritidis cases. A total of 525 isolates were phage typed and the most common phage types were PT8 (23.0%), PT4 (16.8%), PT1 (13.6%), PT21 (10.1%), PT6 (6.5%), and PT14B (5.3%) (Table A2).

There were 411 reported episodes of S. Typhimurium corresponding to an incidence of 7.6 per 100,000 inhabitants (Table A1). This is a 27% decrease compared to 2005. Figure 5 shows the geographical distribution of S. Typhimurium cases.

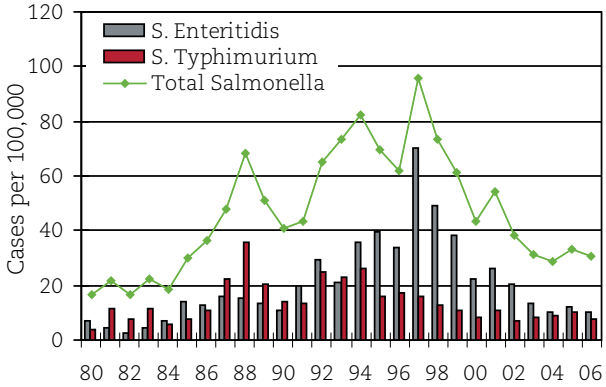


Figure 3. Incidence per 100,000 of human salmonellosis in Denmark, 1980-2006.
Source: SSI

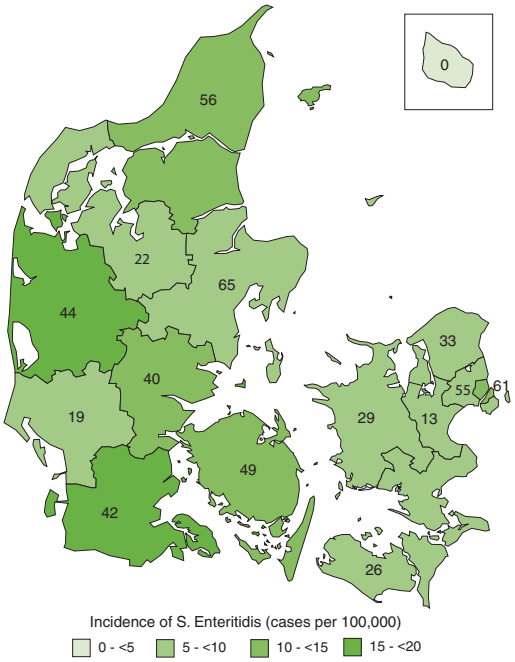


Figure 4. Geographical distribution of human cases per county and incidence of human infections with S. Enteritidis, 2006. For nine cases no information about county was provided.
Source: SSI

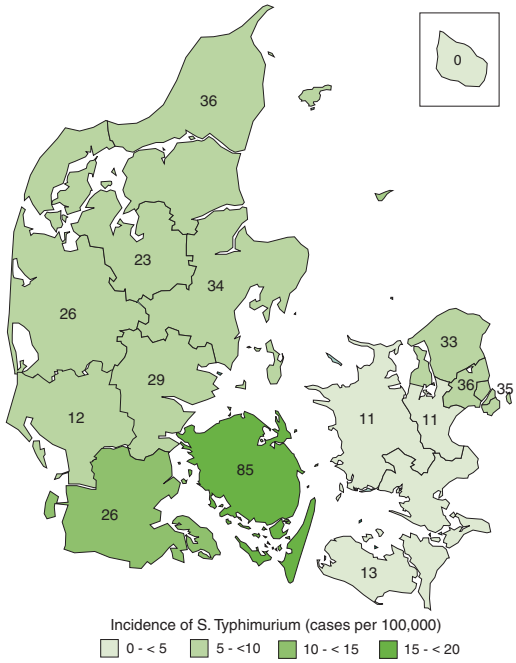


Figure 5. Geographical distribution of human cases per county and incidence of human infections with S. Typhimurium, 2006. For one case no information about county was provided.
Source: SSI

The distribution of phage types (DT) is presented in Table A3. Out of 353 isolates phage typed, the most common types were DT104 (22.1%), DT120 (15.6), DT12 (5.1%) and DT193 (3.4%). Unspecified types accounted for 8.2% of isolates. MIC drug-resistance determinations were performed on 408 isolates. Multi-drug resistance (i.e. resistance to four or more different classes of antimicrobials) was observed in 44% of isolates, whereas 32% were susceptible to all drugs tested. Resistance towards nalidixic acid was seen for 4.7% of the isolates. In 2006, 94 human cases of DT104 and DT104b were reported and 83 (88.3%) of these were caused by multi-drug resistant strains. Unfortunately, very little information was provided conserning the origin of infections.

Other *Salmonella* serotypes accounted for 687 episodes, an increase of 20% compared to 2005 and corresponding to an incidence of 12.6 per 100,000 inhabitants (Table A1). The most commonly encountered serotypes were S. Newport (57 cases), S. Braenderup (57 cases), S. Stanley (49 cases), S. O:4,5,12,H:i:- (33 cases), S. Virchow (33 cases),S. Infantis (32 cases), S. Java (30 cases), S. Dublin (27 cases), S. Agona (24 cases), and S. Hadar (19 cases), (Table A4). This is the first year the group of 'other serotypes' accounted for more cases than S. Enteritidis. The S. Braenderup cases included an outbreak which occurred among Danish military personnel stationed in Iraq. Forty-one persons tested positive when examined after returning to Denmark. The S. Newport cases included cases who were part of an outbreak in a holiday centre in North Jutland (FUD no 611) as well as several travel-related cases. The S. Stanley episodes included many cases infected in Southeast Asia. An increase in the number of patients infected with S. O:4,5,12,H:i:- ("monophasic S. Typhimurium") was also seen. This may be part of an international trend. The S. O:4,5,12,H:i:- were part of several reported outbreaks and it is possible that at least part of them would be more correctly categorised under S. Typhimurium. It is also possible that isolates catagorised as S. Typhimurium in some diagnostic laboratories are in fact S. O:4,5,12,H:i:-. Patients reported with S. Java included cases from an outbreak (FUD no 645).

2.2 Trends and sources in human salmonellosis

To obtain a better understanding of the dynamics of the occurrence of human *Salmonella* infections, the DZC has applied a mathematical model to estimate the contribution of the major animal and food sources to human infections with *Salmonella*. This model is based on a comparison of the number of human cases caused by different *Salmonella* sero- and phage types with the distribution of the *Salmonella* types isolated from the various animal-food sources. Resistance profiles

Table 3. Estimated no. of reported human cases and percentage of cases per major food source, travel or outbreaks, 2004-2006.

	2006		2005		2004	
Source	Estimated no. of reported cases (95% credibility interval)	Percentage of reported cases	Estimated no. of reported cases (95% credibility interval)	Percentage of reported cases	Estimated no. of reported cases (95% credibility interval)	Percentage of reported cases
Pork	101 (77-129)	6.1	215 (159-278)	12.1	142 (109-175)	9.2
Beef	23 (12-33)	1.4	26 (17-38)	1.5	22 (15-30)	1.4
Table eggs	103 (81-124)	6.2	214 (182-249)	12.1	100 (76-126)	6.5
Broilers	8 (3-16)	0.5	72 (45-101)	4.1	66 (37-101)	4.3
Ducks	12 (3-23)	0.7	13 (6-25)	0.7	11 (3-25)	0.7
Imported pork	26 (12-43)	1.6	45 (15-89)	2.5	98 (68-133)	6.4
Imported beef	22 (12-34)	1.3	66 (34-99)	3.7	10 (6-14)	0.7
Imported chicken	152 (123-184)	9.2	194 (152-238)	10.9	147 (109-186)	9.6
Imported turkey	87(67-108)	5.2	18 (0-62)	1.0	46 (27-66)	3.0
Imported duck	11 (5-20)	0.7	7 (0-25)	0.4	5 (1-13)	0.3
Travels[1]	410	24.7	426	24.0	415	27.0
Unknown	605 (556-653)	36.5	451 (392-511)	25.4	425 (368-481)	27.6
Outbreaks, unknown source	98	5.9	28	1.6	51	3.3
TOTAL	1,658	100	1,775	100	1,538	100

[1]The estimate of travel-associated cases should be interpreted carefully, since data concerning travel history was incomplete for 2004-2006.

Source: DZC

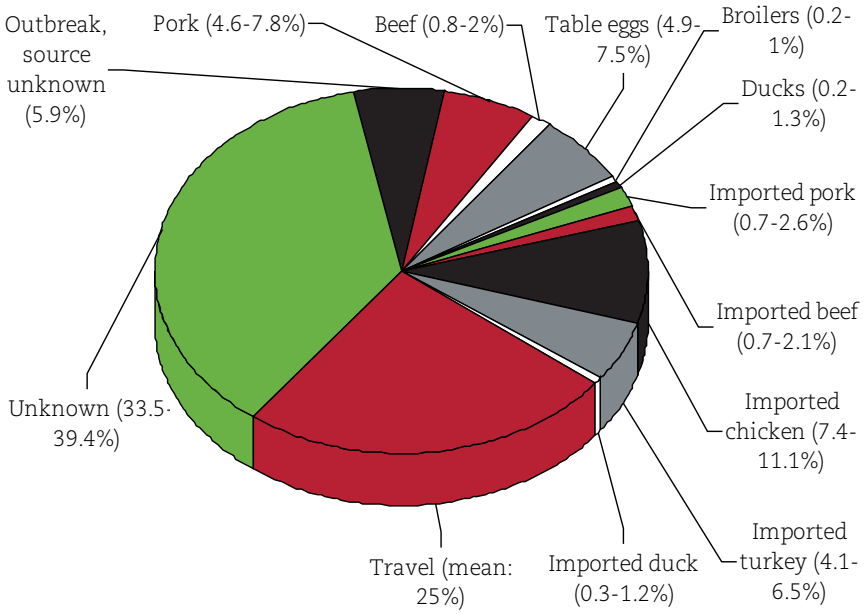


Figure 6. Estimated sources of 1,658 cases of human salmonellosis in Denmark, 2006 (See also Table 3). The estimate of travel-associated cases should be interpreted carefully, since data concerning travel history were incomplete in 2006.

of *S.* Typhimurium isolates were also included to further distinguish between similar phage types found in animals, food and humans.

In 2006, the estimated mean number of cases (per 100,000 inhabitants) that could be attributed to the various food of animal origin was: table eggs: 1.9; pork: 1.9; beef: 0.4; broilers: 0.1; ducks: 0.2; imported poultry products: 4.6; imported pork: 0.5; imported beef: 0.4; cases related to outbreaks: 1.8 (see comment below); travel related cases: 7.5; unknown source: 11.1 (Figure 6).

A significant decrease from 30% in 2005 to 15% in 2006 in the number of cases attributed to the consumption of Danish produced food was observed (Table 3). The decrease is mainly due to fewer human cases caused by Danish pork (53% reduction) and table eggs (52%). For imported foods, the estimated number of human cases was 18% in 2006, which is similar to previous years. However, the distribution between imported products has changed since the estimated number of human cases due to imported turkey meat increased almost 5 times in 2006. In 37% of the cases no source of infection could be estimated. Figure 7 shows the estimated number of cases associated with the three major Danish infection sources from 1988-2006.

The majority of the cases (87%) reported in 2006 had no travel information. As a consequence, the uncertainty attached to the estimate of travel-associated cases is large and it should be interpreted with care. A considerable proportion of the cases in the unknown category may in fact be travel related. In 2006, 410 cases were estimated to be travel-related; 185 of these cases reported travelling before the onset of symptoms.

S. Typhimurium was reported as the cause of infection in 411 cases; 49 of the cases were estimated to be travel-associated. Of the remaining 362 domestically acquired cases, 88 were associated to the consumption of domestically produced foods and 39 associated to imported foods, while 235 of the cases had unknown source of origin. 61 of the cases with unknown source were related to 4 outbreaks (Table 1). In total, 18% of the *S.* Typhimurium cases caused by Danish produced foods

Figure 7. Trends and sources of human salmonellosis in Denmark, 1988-2006.
Source: DZC

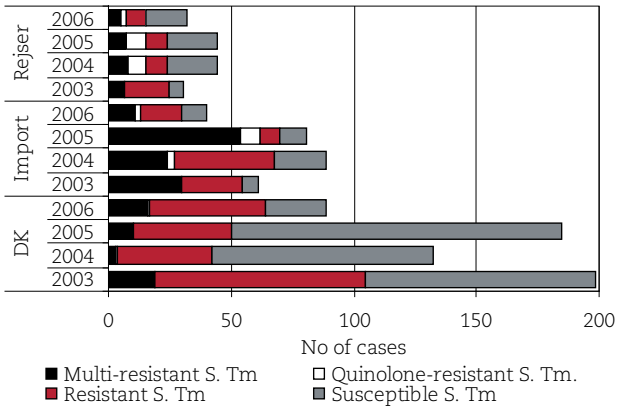


Figure 8. Sources of antimicrobial resistant* Salmonella *Typhimurium infections in humans, 2003-2006.
Source: DZC

were multi-resistant (resistant to more than four antimicrobials), 1% were quinolone-resistant, 53% were resistant (resistant to less than four drugs) and 28% were susceptible (Figure 8). In cases related to imported foods, 28% of the cases were multi-resistant, 5% quinolone-resistant, 42% resistant and 25% susceptible. In 2006, 54% the multi-resistant and quinolone-resistant infections in humans were acquired from products produced outside Denmark, either through imported foods or by travelling abroad. It should be noted though that it was only possible to make inference about attribution of cases to specific food sources for around 20% of the S. Typhimurium cases due to many untypable strains or unavailable data. Consequently, the results reported for 2006 should be interpretated with care.

2.3 Poultry and poultry products

The national *Salmonella* control programme for poultry implemented in 1996 and has been adjusted over the years, the present sampling scheme is summarised in Table A22. All poultry flocks in the production line are monitored for *Salmonella*. Hobby flocks and barnyard flocks producing eggs for consumption in own household only are not obligated to test for *Salmonella*, but may do so voluntarily.

The daily administration of this programme is performed by the Danish Poultry Council (DPC) under the supervision of the DVFA. Slaughter or destruction of infected parent flocks in compliance with the Zoonosis Directive is covered by governmental funds. The government also reimburses the value of hens sampled from suspected layer flocks. Expenses related to routine sampling are covered by the producers except in small layer flocks, where 75% of the expenses are covered by the government.

Table-egg production

None of the 17 examined central rearing flocks or 11 examined adult breeding flocks were positive for *Salmonella* in 2006. Two pullet-rearing flocks were positive for *Salmonella* (0.7%). One flock was serologically positive only and one flock was infected with S. Typhimurium DT193 (Table A5). This phage type was also found in a number of cattle herds in the same geographical area (See text box, section 1.3). Since the introduction of the surveillance programme in the table-egg production in 1996, the percentage of positive flocks has declined significantly. In the central rearing production only two positive flocks have been found since 1998 and no positive adult breeder flocks have been found since 1999 (Figure 9, Table A5).

In flocks producing eggs for egg-packing centres, *Salmonella* was found in 0.4% (2 flocks) of the flocks examined, compared to 1.1% in 2005 and 0.8% in

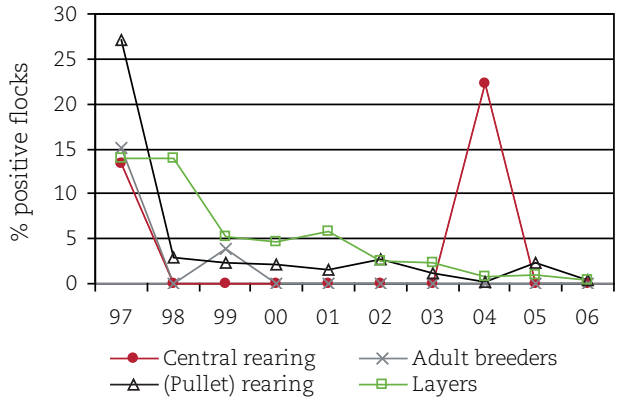


Figure 9. Percentage* Salmonella *positive breeding, rearing and laying flocks in the table-egg production, 1997-2006.
Source: DVFA

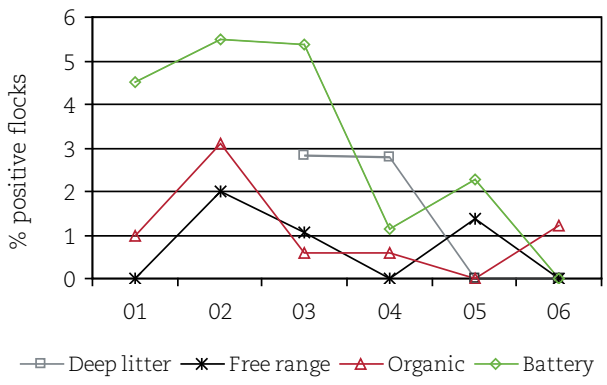


Figure 10. Percent* Salmonella *positive table-egg layer flocks according to type of production, 2000-2006.
Source: DVFA

2004 (Figure 10, Table A5). Both seropositive flocks were small organic flocks with 100 and 3,000 animals, respectively and S. Enteritidis FT8 was isolated from the flock with 3,000 animals. In total, 164 organic flocks, 185 free-range flocks, 148 battery flocks, 6 net flocks and 62 deep-litter flocks were examined. Out of 395 examined barnyard flocks, from which eggs are sold directly to the consumer, 7 flocks (1.8%) were infected with *Salmonella*.

Broiler production

No central rearing flocks were positive for *Salmonella* in 2006. Two adult breeding flocks were positive for Salmonella (3.8% of the flocks). Both holdings were infected with S. Typhimurium.

In broiler flocks, the monthly percentage of positive flocks ranged from 0% to 6.1% with an annual prevalence of 2.2% (Table A6). This is similar to 2005, but higher than the levels observed during the years 2001-2004 (Figure 11). An outbreak with S. Tennessee was observed from late summer until late fall 2006. In total, 11 flocks were positive for S. Tennessee and the industry traced the source to be a specific feed mill delivering feed to all holdings involved in the outbreak. As has been reported in previous years the most common serotype found in 2006 was S. Typhimurium (17.1%) followed by S. Infantis (14.0%) S. Derby (12.8%) and S. 4,12:B:- (10.4%) of the positive flocks. Sero- and phage type distributions are presented in Tables A2-A4.

The mandatory examination of end-products was carried out through sampling of batches of chicken cuts shortly prior to packaging. A batch is defined as the amount of meat from animals slaughtered between two cleanings and disinfections of the processing equipment. In 2006, the monthly percentage of positive batches ranged from 0% to 6.9% with an annual prevalence of 1.9% (Figure 12, Table A6), which is a decrease compared to 2005, where 2.3% of the batches were positive. The decrease is probably explained by the unusually long period with no positive batches in the first half of the year. However, no explanation has been given for this observation.

From the middle of the year 2005, the two main producers of poultry meat were approved to market *Salmonella*-free poultry meat. As a part of this approval they were allowed to take verification samples for *Salmonella* once a week instead of following the programme set up in the legislation where samples are taken each day. As a consequence, the overall number of tested batches has declined. Under this special sampling programme, one batch was found positive for *Salmonella* after slaughter in 2006. The incriminated batch was not marketed as *Salmonella*-free and corrective actions were carried out.

Turkey production

Since 2004, turkeys have not been slaughtered commercially in Denmark, as the only major turkey slaughterhouse closed down. Most turkeys raised in Denmark are transported abroad for slaughter. In 2006, 32 flocks were tested before slaughter for *Salmonella* and all found negative (Table A8).

Duck production

Duck flocks were monitored by the mandatory ante-mortem (AM) examination prior to slaughter. In 2006, 255 flocks were examined. *Salmonella* was isolated from 207 (81.2%) of the flocks. This is a 15.6% increase compared to 179 positive flocks reported in 2005. Since 2004 the total number of tested flocks has increased with 41% and the number of positive flocks has increased with 41%. Further, the average number of serotypes per flock

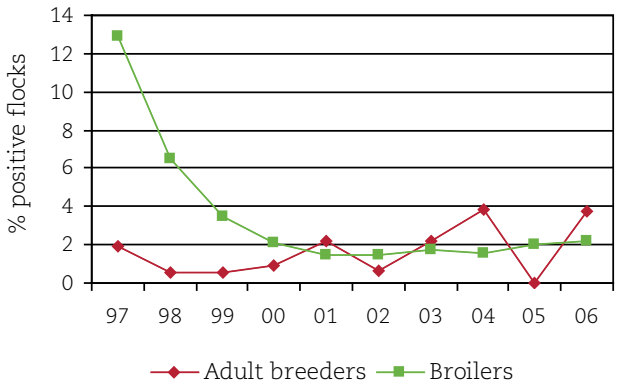


Figure 11. Percentage Salmonella ***positive adult breeders and broilers in the broiler production, 1997-2006.***
Source: DVFA

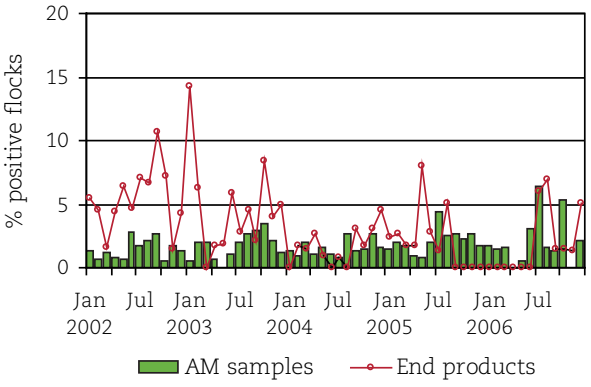


Figure 12. Percent Salmonella ***positive broiler flocks detected at the mandatory ante-mortem (AM) and end product examination, 2002-2006.***
Source: DVFA and DMA

EU Baseline study on the prevalence of *Salmonella* in broilers

Background

As a part of the new Zoonosis directive1 and regulation2 the Commission has initiated EU-studies of the *Salmonella* prevalence in poultry breeders, table-egg layers, broilers, slaughter pigs and turkeys - so called Baseline Studies. The objective is to generate comparable prevalence data from all Member States with the purpose of setting common EU targets.

The investigation of the *Salmonella* prevalence in broiler flocks was carried out from October 2005 to September 2006. All flocks with more than 5,000 animals were tested.

The veterinary officers from the RVFCA collected five sock samples from each flock. All samples were analysed at the National Food Institute. If a sample tested positive, the holding was considered positive. One isolate from each positive sample was serotyped, and samples positive for S. Typhimurium and S. Enteritidis were also phage typed. Further, testing of antimicrobial susceptibility was performed on one isolate per serotype per flock.

Results

324 flocks from 238 holdings were sampled during the survey; from 86 holdings two flocks were tested.

314 flocks tested negative and 10 flocks (3.1%) tested positive for *Salmonella*.

- 1 flock was infected with S. Typhimurium DT15a
- 3 flocks were infected with S. Derby; 2 of these came from the same holding
- 2 flocks were infected with S. Infantis
- 1 flock was infected with S. Meleagridis
- 1 flock was infected with S. Agona
- 1 flock was infected with S. 4,12:b:-
- 1 flock was infected with S. Kentucky

There were no findings of S. Enteritidis.

Based on the summary report prepared by the European Food Safety Authority, the Commission will establish the EU-targets for *Salmonella* reduction in broiler flocks.

[1] Directive 2003/99/EC
[2] Regulation 2160/2003/EC

increased from 1.2-1.3 in previous years to 1.9 in 2006, but no explanation is given for this increase. In 2006, the most frequently isolated serotypes were S. Anatum (19.9%), S. Kottbus (16.9%), and S. Indiana (12.3%) (Table A4).

2.4 Pig and pork production

In 1995, a serological surveillance programme for detection of *Salmonella* infection in slaughter-pig herds was implemented. The programme has been adjusted over the years and revisions have previously been described in Annual Reports 2000-2002. The sampling scheme is summarised in Table A23. Originally, the DVFA was responsible for the administration of the programme. However, since 2002, the Danish Bacon and Meat Council, now the Danish Meat Association (DMA) has carried out the daily administration, under the supervision of the DVFA. All data from the surveillance of *Salmonella* in pigs are recorded in the central Zoonosis Register, which is part of the Central Husbandry Register, administered by the DVFA.

Surveillance by serological testing of meat juice is carried out in herds producing more than 200 slaughter pigs per year (11,239 herds in December 2006). Each month, a serological slaughter pig index (SP-index) is calculated for each herd based on the proportion of seropositive meat-juice samples from the last three months. The index gives more

weight to the results from the most recent month (1:1:3). The SP-index serve to assign the slaughter pig herds to one of three infection levels:

- Herds in Level 1 have none or only a small proportion of positive samples,
- Herds in Level 2 have a higher proportion of positive samples,
- Herds in Level 3 have an unacceptably high proportion of positive samples.

In July 2005, the surveillance system was changed into a risk-based surveillance (RBOV), following which the sample size in herds with a SP-index of zero (no positive samples in the previous 3 months) was reduced to one sample per month. This change reduced the annual sample size gradually from approximately 570,000 meat-juice samples in 2004 to approximately 250,000 in 2006. The seroprevalence has been fluctuating around 9% since October 2003 (Figure 13).

It is mandatory to collect pen-faecal samples from herds placed in level 2 or 3 in order to clarify the distribution and type of *Salmonella* infection. Furthermore, the producers are paid a reduced price per animal from these herds. Pigs from herds Level 3 must be slaughtered under special hygienic precautions. In 2006, the monthly number of herds assigned to Level 2 and Level 3 declined on average 26% and 35% respectively compared to 2005. No full explanation is given for this decrease, but it is in partly due to exclusion of herds which have stopped to deliver slaughter pigs. By the end of the year 2006, 2.5 % and 0.9% of the herds were assigned to Level 2 and 3, respectively.

Sow herds supplying piglets to slaughter-pig herds in Level 2 or 3 are obligated to collect pen-faecal samples to identify the *Salmonella* type and to clarify possible transmission of *Salmonella* from sow herds to slaughter-pig herds. Each of the 200 Danish breeding and multiplying pig herds are monitored monthly through serological testing of 10 randomly collected blood samples from pigs 4-7 months of age. The overall seroprevalence in pigs from breeding and multiplying herds remained at the 2005 level in the first half of 2006 (approx. 3.2%) but increased to approx 4.5% in the second half of 2006.

Each month, a serological breeder- and multiplier index (BM-index) is calculated for each herd, based on the mean serological reaction from the last three months. The index gives more weight to the results from the more recent months (1:3:6). If the BM-index exceeds 5, it is mandatory to collect pen-faecal samples for *Salmonella* analysis (Table A23) and the herd owner must inform buyers of breeding animals about the infection level and *Salmonella* type in the herd. An increase in the percentage of breeding and multiplying herds exceeding the threshold was observed from 2001 until a peak at 12% in the beginning of 2004. Since then the percentage of herds exceeding the threshold has been fluctuating around 8% (generally between 6% and 10%), and it was higher in the second half of 2006 than in the beginning of the year (Figure 14).

Clinical disease (not necessarily salmonellosis) in combination with finding of *Salmonella* was recorded in 40 herds (Table 4). Five of these herds were placed under official veterinary supervision due to salmonellosis.

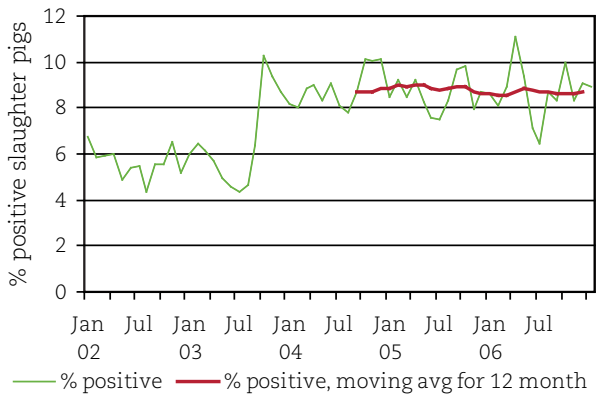


Figure 13. Serological surveillance of* Salmonella *in slaughterpigs. Percentage of seropositive meat juice samples (first sample per herd per month), 2002-2006. The abrupt increase in 2003 was attributed, in part, to analytical-technical adjustments.
Source: DVFA

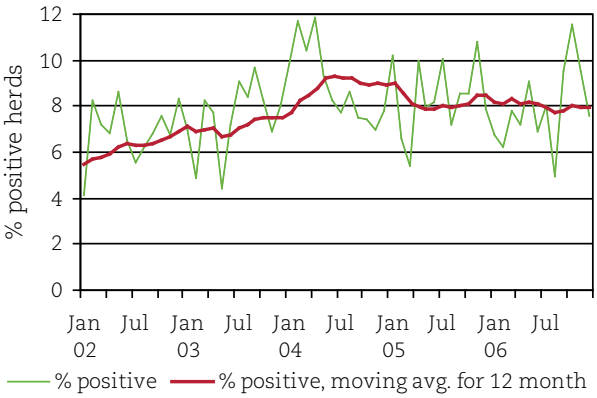


Figure 14. Serological surveillance of* Salmonella *in breeding and multiplying pig herds. Percentage of herds with a seropositive index >5, 2002-2006.
Source: DMA

Table 4. Isolation of **Salmonella** *from outbreaks of clinical disease in pig and cattle herds, 2006.*

Serotype and phage type	Pigs herds	Cattle herds
9,12.-:-	-	2
Derby	4	-
Dublin	-	30
Infantis	2	-
Tennessee	-	1
Typhimurium DT10	-	1
Typhimurium DT104MR	20	6
Typhimurium DT120	-	6
Typhimurium DT15a	-	1
Typhimurium DT17	1	2
Typhimurium DT170	2	-
Typhimurium DT193	6	14
Typhimurium DT8	-	2
Typhimurium NT	3	-
Typhimurium U302	1	-
Virchow	1	-
TOTAL	40	65

Source: DVFA

Monitoring of *Salmonella* in pork is based on swab samples taken from three designated areas of chilled half-carcasses at the slaughterhouse. Samples from 5 carcasses are pooled, except in slaughterhouses slaughtering 50 pigs or less per month in which case samples are analysed individually. When estimating the prevalence of *Salmonella*, both the loss of sensitivity and the probability of more than one sample being positive in each pool are taken into consideration. A conversion factor has been determined on the basis of comparative studies, as described in Annual Report 2001. In 2006, 27,892 swab samples were collected and pooled and the prevalence of *Salmonella* in single swab samples was estimated to be 0.9%. An additional 121 samples were collected from slaughterhouses with a small production and were analysed individually. None of these samples were positive for *Salmonella* (Figure 15, Table A9). Based on results from the previous 12 months, the moving average has declined from 1.0% in January to 0.9% in December. As in previous years, the most common serotypes observed were S. Typhimurium (41.3%), S. Derby (22.6%) and S. Infantis (5.2%). The sero- and phage type distributions are presented in Tables A2-A4.

The contingency plan III for pigs stopped at the end of 2006 and the goal of having less than 1.2% positive samples was achieved. The contingency plan has been extended until a new contingency plan is in place.

2.5 Cattle and beef production

A national programme for surveillance of S. Dublin was established in 2002. This programme divides cattle herds into three levels (Table A10). The herds are assigned to the levels based on serological results from milk and blood samples or on account of contact with herds assigned to a higher infection level. The S. Dublin surveillance programme was described in the Annual Report 2003 and the sampling scheme is summarised in Table A24.

In January 2007, 16.0% of milk-producing herds were classified into level 2 (Table A10), which is a decrease compared to 2005 where 18.9% of the herds were assigned to level 2. For the non-milk producing herds, the percentage of herds in level 1 increased from 52.8% in 2005 to 77.5% in 2006.

In general, herds with clinical salmonellosis are placed under official veterinary supervision and animals from these herds are slaughtered under special hygienic precautions. However, herds with S. Dublin, where the disease is confined to a minor part of the herd, may only be subjected to hygienic slaughter.

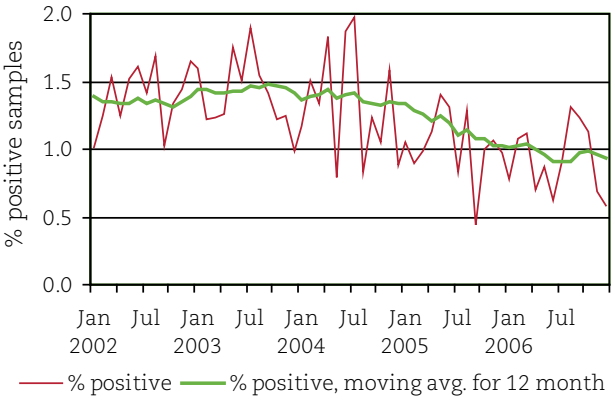


Figure 15. **Salmonella** *in pork, monitored at slaughterhouses, 2002-2006. Swab samples from 3 designated areas of chilled half carcasses.*
Source: DVFA

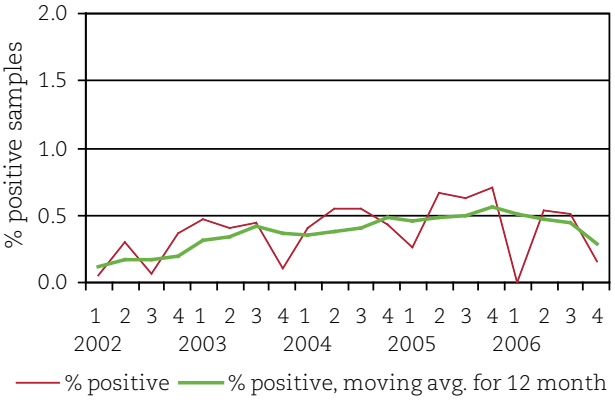


Figure 16. **Salmonella** *in beef, monitored at slaughterhouses, 2002-2006. Swab samples taken from 3 designated areas of chilled half-carcasses.*
Source: DVFA

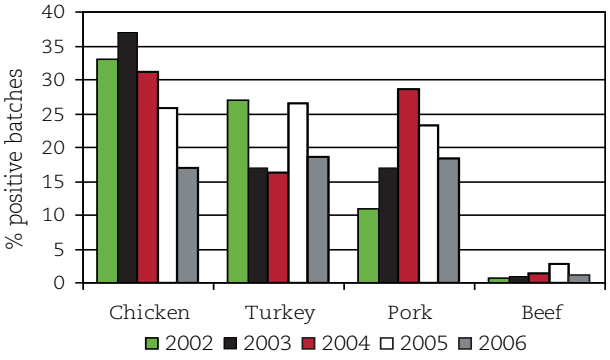
Clinical disease (not necessarily salmonellosis) in combination with the finding of *Salmonella* was recorded in 65 herds (Table 4). Of these, 54 herds were placed under official veterinary supervision, while 2 were subject to hygienic slaughter due to confirmed infections of S. Dublin. No herds were placed under official veterinary supervision due to finding of multiresistant S. Typhimurium DT104 (MRDT104) in 2006. Herds are placed under official veterinary supervision if MRDT104 is found in the animals, or the herd has been in contact with herds infected with MRDT104.

Monitoring of *Salmonella* in beef and veal at slaughterhouses is based on swab samples taken from three designated areas of chilled half-carcasses. Samples from 5 carcasses are pooled, except in slaughterhouses slaughtering 50 cattle or less per month, in which case the samples are analysed individually. In 2006, 8,005 samples were pooled and the prevalence of *Salmonella* was estimated to be 0.3% after using the conversion factor in the same manner as described for pork. An additional 191 samples were collected from slaughterhouses with a smaller production and analysed individually. All samples were negative (Table A11). In 2006, the 12 month moving average decreased for the first time since 2001 and was 0.3% in December (Figure 16). In total, S. Dublin was isolated from 76.9% of the positive samples (Table A4).

2.6 Imported meat and meat products

The surveillance programme for multi-drug resistant S. Typhimurium DT104 (MRDT104) (described in Annual Report 2001) also provides information on the prevalence of *Salmonella* types other than MRDT104 in imported meat. The sampling programmes for imported and Danish fresh meat from poultry, pork and beef are very different, and comparison of the results should be done carefully. Still, the results indicate that the prevalence of *Salmonella* in imported poultry and pork is higher than the prevalence in Danish produced poultry and pork.

In 2006, a total of 990 batches of imported fresh meat were sampled and 0.8% of the batches was positive for MRDT104. This is a decrease compared to 2005, where 1.5% of the batches was positive for MRDT104. In total, the proportion of positive batches decreased from 17.2% in 2005 to 13.3% in 2006. In chickens, turkeys, pork and beef, the number of positive batches was 17.0%, 18.6%, 18.5% and 1.2%, respectively (Table A12, Figure 17). Part of the decrease might be explained by a possible change in the countries of origin, since there are large differences in the prevalence in different countries.



Figur 17. Percent* Salmonella *positive batches from the import control, 2002-2006.
Source: DVFA

From November 2006 the surveillance of imported meat was changed to the "case-by-case" system (see textbox in section 1.3 for descripion).

2.7 Feeding stuff

The Danish Plant Directorate inspects all feed compounders at risk for the presence of *Salmonella*. The EU regulation on feed hygiene (183/2005) came into force in January 2006 and the Danish Plant Directorate changed focus from control of the feed to control of the feed business operators. Therefore fewer samples are collected by the Danish Plant Directorate (see Table A13) and more samples are collected by the feed producers as part of their own-check programme. In 2004 and 2005, the Danish Plant Directorate sampled soy bean products when they were landed in Danish ports. This monitoring is now carried out by the importers.

The Plant Directorates routine inspection of feed includes:

- The presence of *Salmonella* in compound feed is indirectly monitored by the environmental samples collected during feed processing. Companies are sampled 1 to 4 times,
- Sampling of feed materials (predominantly soy bean meal and rapeseed cake). 200 samples per year,
- Samples from transport vehicles (hygiene samples) prior to loading of feed compounds. 200 samples per year.

In general, the prevalence of *Salmonella* in feed was low in 2006 and at the same level as in previous years (Table A13).

In 2006, the Danish Plant Directorate conducted a screening of *Salmonella* in feed grain. In Denmark, 70% of the feed quantity is made up by grain (approximately 7 mill tons a year). Therefore even a low prevalence would be of importance. The screening included half wheat and half barley, both from long term storage and newly harvested grain. In total, 719 samples were collected from a large variety of storage conditions and only one sample was positive (S. Enteritidis). The result confirmed the presumption that grain is not a source of *Salmonella*. The positive sample was collected from a farm where the sampling site could easily have been contaminated by the herd animals or wildlife. This hypothesis of cross-contamination is supported by the fact that S. Enteritidis is a frequent serotype in humans and herds in Denmark, but rare in feed (not detected in the previous 5 years).

In 2006, an outbreak with S. Tennessee was reported in the broiler production and the industry traced the source to be a specific feed mill (see section 2.3 'broiler production' for more information). S. Tennessee was also identified during the feed mills own-check programme.

2.8 Rendering plants

Three different categories of meat and bone meal by-products, not intended for human consumption, have been set by Regulation No. 1774 of 03/10/2002.

- Category 1 material must be processed at special processing plants and by-products of these cannot be used for feeding purposes,
- Category 2 material must be processed at category 2 processing plants. Products of these may be used for feed for fur animals,
- Category 3 materials are by-products from healthy animals, slaughtered in a slaughterhouse and processed at category 3 processing plants. Products of these may be used for petfood and for feed for fur animals.

Monitoring of hygiene at the processing plants is mainly based on the plant's own-check programmes, which are inspected by the RVFCA. Positive *Salmonella* samples must be reported to the RVFCA. In 2006, 9,440 samples of meat and bone meal were examined for *Salmonella*. Of these, 4,817 were collected as part of the plants' own-check programme and the remaining 4,623 samples as controls of the products. In total, 2.5% of the samples was found positive for *Salmonella* and all isolates were serotyped. S. Livingstone and S. Kentucky were the most common serotypes found (Table A14).

2.9 Pets, zoo animals and wildlife

A small number of samples from pets, zoo animals and wild life are tested for *Salmonella* at the National Veterinary Institute (Table A15). As in previous years, samples from pets were tested on clinical indication only, and none of the examined samples from dogs or cats were found positive for *Salmonella* in 2006. Of other pet animals (including rodents and reptiles) one snake was found positive with S. Muenchen.

Zoo animals examined for *Salmonella* were mainly birds and mammals. In 2006, zoo animals were tested on indication and of the 94 samples from mammals and reptiles, 6 were positive for *Salmonella*. One tiger kitten had S. Typhimurium, a marmoset had S. Crewe, a hedgehog had S. Apapa, two snakes had S. Muenchen and one snake had S. Newport. Samples from 81 zoo birds were examined for *Salmonella* and 2 samples tested positive (S. Typhimurium in a loris and S. Thompson in a spoonbill).

S. Enteritidis was isolated from 8 hedgehogs out of 163 wild animals submitted to the National Veterinary Institute by hunters, veterinarians or the public.

3. Campylobacter

3.1. Humans

Since 1999, campylobacteriosis has been the leading cause of bacterial gastrointestinal disease in Denmark. In 2006, there were 3,242 reported cases (Table A1), corresponding to an incidence of 60 cases per 100,000 inhabitants (Figure 18). This constituted a decrease of 12% compared to the number of infections the year before. The incidence of *Campylobacter* in humans has a distinct seasonal distribution, with a summer peak in June-September. Consumption and handling of poultry and poultry products is generally accepted to be the primary source of human campylobacteriosis in Denmark, though other sources also exist. Data on travel history is currently not reliably recorded in the surveillance system; therefore, the incidence of people infected outside Denmark is unknown. It is estimated that approximately one third of cases are travel related. The geographical distribution of human infections caused by *Campylobacter* is shown in Figure 19. Outbreaks of human campylobacteriosis are generally rare, however several small and one medium-sized outbreak was recorded in 2006 (see Section 1.2, Table 1).

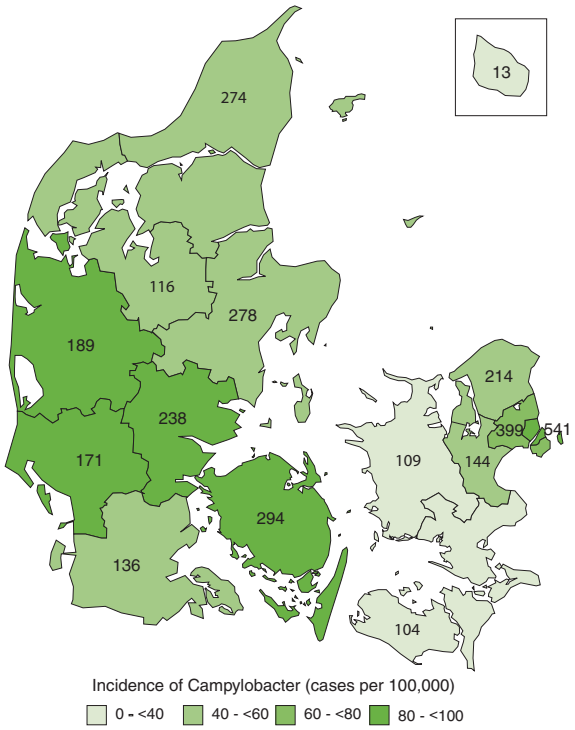


Figure 19. Geographical distribution of human cases per county and incidence of human campylobacteriosis, 2006.
Source: SSI

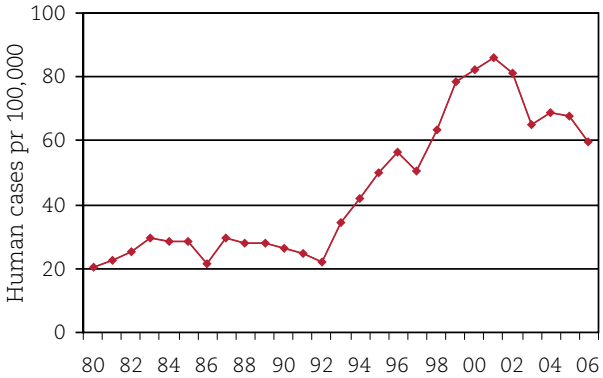


Figure 18. Incidence per 100,000 of human campylobacteriosis in Denmark, 1980-2006.
Source: SSI

3.2. Poultry

The voluntary intervention strategy for reducing the number of *Campylobacter*-positive broiler flocks was implemented in 2003 and continued in 2006. The strategy include strict hygiene and bio-security measures at the farm, and higher prices paid to the farmers delivering *Campylobacter*-negative flocks and has been described in the Annual Report 2003. All broiler flocks are sampled for Campylobacter at the slaughterhouse prior to slaughter, where ten cloacal swabs are collected from each broiler flock/batch, and analysed as one pooled sample per flock/batch using a PCR detection method.

In 2006, there were 29.9% *Campylobacter* positive flocks (Table A7). This is a significant decrease compared to the years prior to implementation of the strategy, where the prevalence was greater than 38%, but at the same level as in the last couple of years (Figure 20). Similar to what is seen for human campylobacteriosis, the prevalence in broilers has a distinct seasonal variation, with a summer peak in July/August. In 2006, the prevalence of positive broiler flocks per month ranged from 7.4% positive flocks in January to 66.0% in August. Although samples were collected from the flocks following transport to the slaughterhouse, it is believed that the observed prevalence reflects the flock status at the farm. Therefore, the significant reduction in prevalence, compared to the years prior to the implementation of the strategy, is considered to be attributable to the enforcement of intervention strategies.

Since 2001, there has been a 30% reduction in the number of human campylobacteriosis cases. This decrease coincide with an almost 25% reduction in the number of positive flocks after the implementation of the voluntary intervention programme in broilers (Table A1 and Figure 20). It is likely that the practice of allocating *Campylobacter*-negative flocks to the production of fresh products and *Campylobacter*-positive flocks for frozen product production, although not completely consistent, contributed to the reduction in human cases.

The PCR-method used in surveillance of *Campylobacter* in broilers does not differentiate between species of *Campylobacter*. However, as part of the monitoring programme for the occurrence of antimicrobial resistance in zoonotic bacteria (DANMAP), approximately one flock from each broiler holding was examined for *Campylobacter* spp. by conventional microbiological methods. Each sample consisted of 10-pooled cloacal swabs. Of the 401 samples investigated, 28.3% were found to be positive for *Campylobacter*. Of these, 92% were identified as *C. jejuni*, 7% as *C. coli* and 1% as *C. upsaliensis*.

No flocks of hens, ducks or turkeys were tested for *Campylobacter* in 2006.

As in the preceding years, the prevalence of *Campylobacter* in chilled and frozen poultry meat was monitored in 2006. Samples were collected at wholesale or retail level and included Danish produced as well as imported poultry meat (Table A7 and A8). Results from the Danish produced chicken meat showed a decline in the prevalence of *Campylobacter* in chilled meat from 23.4% in 2005 to 12.5% in 2006, and in frozen meat from 22.8% in 2005 to 15.3% in 2006 (Figure 21). It is likely that the introduced interventions have contributed to this decrease but also seasonal variation between years could be an influencing factor. In addition, surveillance on Danish, chilled products were carried out at two major slaughterhouses. Samples of packaged products were taken weekly and 7.9% (76/959) were positive. This was a slight decrease compared to 2005 where 10.0% was positive. The surveillance continues in 2007.

The prevalence of *Campylobacter* in imported, frozen chicken meat was slightly lower in 2006 compared to 2005, however the prevalence in 2005 and 2006 was still noticeably higher than in earlier years (Figure 21). The prevalence of *Campylobacter* in imported, chilled products decreased significantly by 25% in 2006 compared to the very high prevalence from 2002 to 2005. This decrease may partly be due to a shift in the proportion of meat imported from different countries, where large differences in the prevalence occur.

In November 2006, an intensified control of *Campylobacter* in imported and Danish fresh meat was initiated. For more information see the textbox p. 10.

Generally, the number of *Campylobacter* positive samples is higher in chilled products than in frozen products. However, in Denmark the difference has been very low since the practice of allocating *Campylobacter*-negative flocks to the production of fresh products and *Campylobacter*-positive flocks for frozen product production started.

The prevalence of *Campylobacter* in chilled, imported turkey meat, decreased slightly from 31.0% in 2005 to 28.6% in 2006 (Table A8). Since 2004, very little turkey meat has been processed in Denmark and only 9 samples were taken in 2006. Two samples were positive.

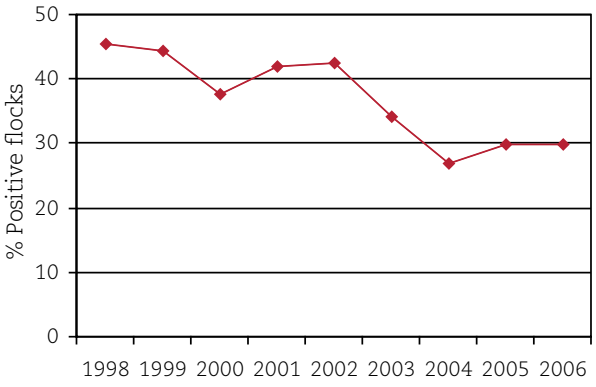


Figure 20. Prevalence of broiler flocks infected with* Campylobacter, *1998-2006.
Source: National Food Institute, DTU

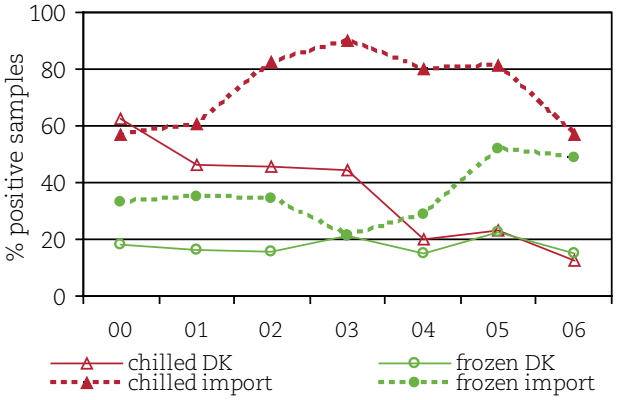


Figure 21. Percent* Campylobacter *positive samples from chilled and frozen, Danish and imported chicken meat at retail, 2000-2006.
Source: National Food Institute, DTU

3.3. Pigs and Cattle

As part of the DANMAP programme, caecal contents from pigs and cattle were sampled at slaughterhouses and examined for *Campylobacter*. In 2006, the prevalence of *Campylobacter* in pigs was 52.2%. This is a marked decrease compared to previous years (Figure 22). The majority of positive isolates was identified as *C. coli* (Table A9). In cattle, the prevalence was 44.2%, which is similar to 2005, but a decrease compared to previous years. The majority of the positive isolates was identified as *C. jejuni* (Table A11). There is no explanation for the observed decrease of *Campylobacter* in pigs and cattle.

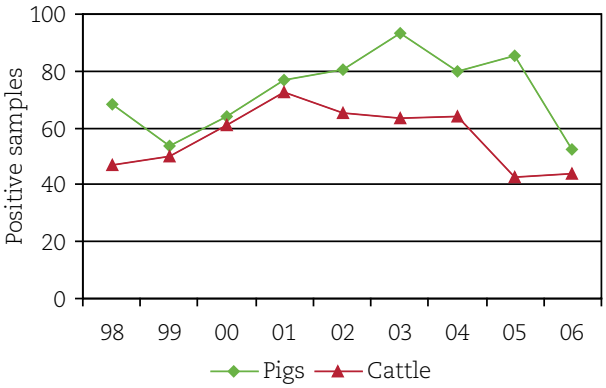


Figure 22. Percent* Campylobacter *positive samples from pig herds and cattle herds. Samples are collected as part of the DANMAP programme, 1998-2006.
Source: National Food Institute, DTU

3.4. Pets, zoo animals and wildlife

Pets, zoo animals and wildlife are not routinely monitored for *Campylobacter* at the National Veterinary Institute, only samples submitted on clinical indications for *Campylobacter* analysis are examined.

Twenty-eight dogs were examined and *Campylobacter* spp. was found in 9 dogs and *C. upsaliensis* in 4 dogs. C. upsaliensis was also found in 2 samples from cats (Table A15).

4. Yersinia

4.1. Humans

In 2006, there were 215 reported infections with *Yersinia enterocolitica* (4.0 cases per 100,000 inhabitants), which is 11% fewer than in 2005 (Table A1). Since 2000, the annual number of infections has been almost unchanged. From 1985 to 2000 the number of cases dropped from more than 1,500 to around 250 cases with *Y. enterocolitica* annually (Figure 23). The majority of infections is believed to be domestically acquired and many patients are children. The median age of patients was 16 years, which is somewhat higher than in preceding years. The primary source of human yersiniosis in Denmark is presumed to be pork and pork products. The geographical distribution of human *Y. enterocolitica* cases is presented in Figure 24.

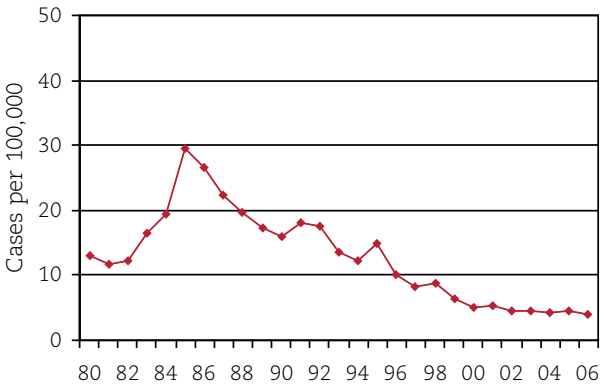


Figure 23. Incidence per 100,000 of human yersiniosis in Denmark, 1980-2006.
Source: SSI

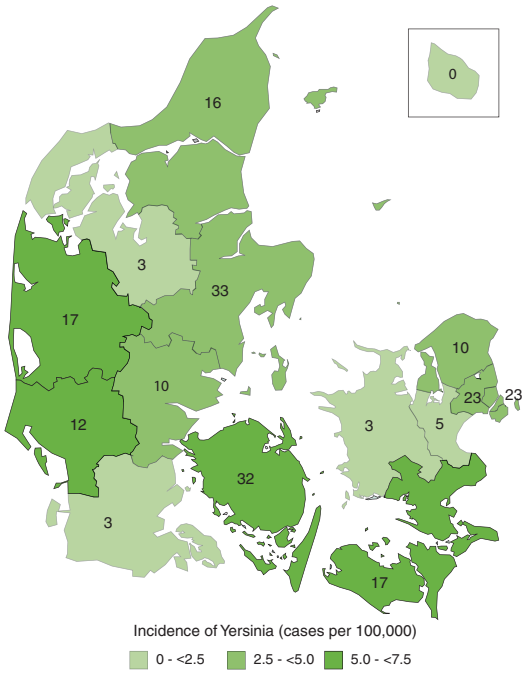


Figure 24. Geographical distribution of human cases per county and incidence of human yersiniosis, 2006.
Source:SSI

4.2. Pigs

In 2005, monitoring for *Yersinia* in pigs stopped.

A project investigating the prevalence of *Y. enterocolitica* in pig carcasses and faecal samples (from a subset of the carcasses investigated) at four different slaughterhouses was carried out in 2005 and 2006. In total, 578 carcass swabs and 400 faecal samples was analysed and 58% and 39% of the samples were positive, respectively. There was a considerable variation between sampling weeks and slaughter houses. The serotyping is not complete; however serotype O3 is by far the most prevalent. Less than 5 *Y. enterocolitica* O9 isolates were recorded. The project continues in 2007.

5. Listeria

5.1. Humans

In 2006, there were 56 reported cases of listeriosis corresponding to an incidence of 1.0 case per 100,000 inhabitants (Table A1). Forty-three cases presented with septicaemia, six with meningitis, five presented with both clinical features, and two were maternofoetal cases. The patients came from all parts of Denmark. The median age was 69 years; 33 were women and 23 men. Based on sero-grouping and PFGE typing, no major clustering indicating the possibility of a shared source of infection could be identified. Forty-two cases were assigned to serogroup 1 and 13 cases to serogroup 4, while the serogroup was undetermined for two cases. During the last few years, the incidence of recorded listeriosis has increased. This increase is mainly observed in serogroup 1 isolates and for cases with septicaemia. The incidence over a 25-year period can be seen in Figure 25.

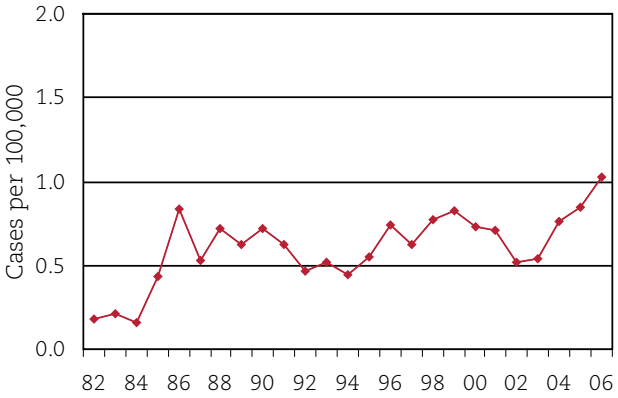


Figure 25. Incidence per 100,000 of human listeriosis in Denmark, 1981-2006.
Source: SSI

5.2. Ready-to-eat food

The EU Regulation 2073/2005 on microbiological criteria for foodstuffs came into force in January 2006 thereby introducing harmonised criteria for *Listeria monocytogenes*. The new EU criteria distinguish between products supporting growth of Listeria and products not supporting growth; all ready-to-eat foods are covered. The results of the monitoring carried out by the RVFCA for *L. monocytogenes* in different food categories is summarised in Table 5.

Table 5.* Listeria monocytogenes *in ready-to-eat foods sampled by the RVFCA, 2006

	Qualitative method		Quantitative method				
Food category	N	Positive samples[a]	N	Samples with less than 1 cfu[b] pr g	Samples with less than 10 cfu pr g	Samples with cfu between 10 and 100 pr g	Samples with more than 100 cfu pr g
Meat products	19	3	668	32	609	18	9
Milk and dairy products	97	0	31	23	8	0	0
Eggs and egg product	10	0	0	-	-	-	-
Fruit and vegetables	2	0	7	0	7	0	0
Fishery products	19	2	202	158	44	0	0
Other products[c]	42	3	131	4	127	0	0
Total	189	8	1,039	217	795	18	9

[a] *Listeria monocytogenes* present in a 25 g sample of the product.
[b] Cfu: The number of colony forming units.
[c] Predominantly ready-to-eat foods.
Source: DVFA

6. VTEC

6.1. Humans

In 2006, there were 146 reported cases positive with verocytotoxin-producing *Escherichia coli* (VTEC); an incidence of 2.7 per 100,000. VTEC cultures were obtained from 137 episodes (some were diagnosed by PCR only), 14% of which were caused by O157 (Table A1). The total distribution of VTEC O-groups, resulting in five or more episodes, is presented in Table A16.

The number of reported infections has decreased by 13% from 2004 to 2006. This follows upon several years of increase in the number of infections from the beginning of surveillance in 1997 (Figure 26); an increase which is primarily assumed to reflect improved diagnostics and increased awareness. However, Denmark does not have a centrally coordinated standard testing method for VTEC and the incidence through the past 10 years has been 3 to 10 times higher in counties using a diagnostic approach involving molecular detection methods. These counties covered approximately 44% of the Danish population in 2006 and have been circled in Figure 27 presenting the geographical distribution of human VTEC infections in Denmark. In 2006, the age group specific incidence in counties using molecular methods was 32.6 in children less than 5 years and 3.7 in cases aged 5 years or more compared to 4.9 and 0.3, respectively, in counties using other methods.

There were no cases of VTEC related Haemolytic Uraemic Syndrome (HUS) notified in 2006. However, sera from 3 cases of HUS were submitted for serological analysis of the most frequent VTEC O-groups and one of these found positive for O103. In 2006, all VTEC isolates were real-time sub-typed using PFGE at the SSI. No general outbreaks occurred, but there were several clusters consisting of two or three cases, most of these constituted family outbreaks.

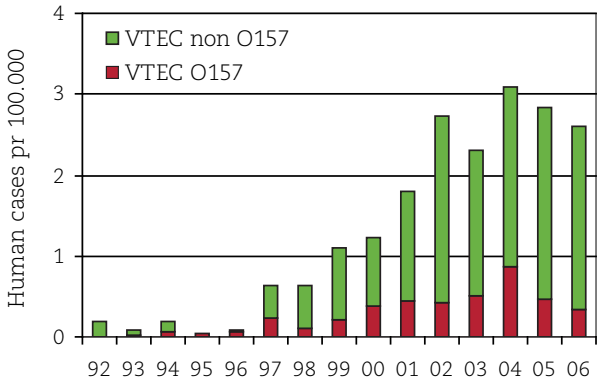


Figure 27. Incidence of human infections with VTEC, 1992-2006.
Source: SSI

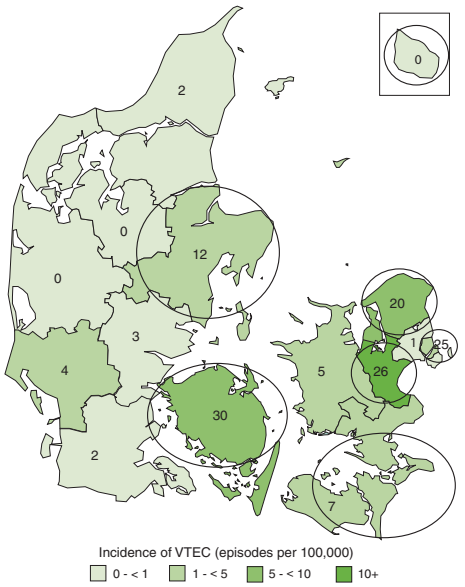


Figure 27. Geographical distribution of human cases per county and incidence of human VTEC infections, 2006. The circled counties offer testing by molocular detection.
Source: SSI

6.2. Cattle

The National Food Institute has monitored the occurrence of VTEC of serogroup O157 in cattle since 1997 through examination of 25 g faecal samples from slaughter calves. The samples were collected at slaughterhouses as part of the DANMAP programme. In 2006, VTEC O157 was isolated from 10.3% of the samples using a immunomagnetic separation method for O157 (Table A11).

From September to December 2006, a survey concerning VTEC in cattle at slaughter was carried out (primarily slaughter calves and cows originating from dairy farms). In total, 603 faecal samples were investigated and 76% of the samples was Verocytotoxin positive (VT1 or VT2) using real-time PCR methods. It is well known that there is a high VTEC prevalence in the cattle population and although not fully elucidated it seems that many VTEC types only have a limited impact on human health. VTEC O157 was isolated from 4.1% of the faecal samples using an immunomagnetic separation method.

6.3. Food

In 2006, a survey concerning the occurrence of VTEC in imported beef and veal was carried out by the DVFA. Samples were collected at importers and at border controls; 152 samples were collected from 32 batches (maximum five samples from each batch). Samples were examined for *E. coli* O26, O103, O111, O145 and O157 using the immunomagnetic separation method. VTEC of the five serogroups were not isolated.

7. TSE

7.1 Human

The human form of variant Creutzfeldt-Jakob disease (vCJD) has never been reported in Denmark. Since 1997, vCJD has been a notifiable disease in Denmark.

7.2 Cattle

The Danish surveillance program continued throughout 2006 (for legislation see Table A21). BSE testing of samples from slaughtered animals is performed at two approved private laboratories in Denmark. Until May 2006, one private laboratory used the Enfer Test (ELISA) using spinal cord or brain stem material and the other private laboratory used the Prionics Check Test (western blotting) using only brain stem material. From May the protocol for Enfer Test (ELISA) was changed so that only brain stem material can be used and at the same time the laboratory formerly using the Prionics Check Test decided to change to the IDEXX technique. All animals-at-risk are tested by either IDEXX or western blot technique (risk categories are presented in table A17). Fallen stock animals are tested at an approved private laboratory, except for a fraction of samples that are analysed at the National Veterinary Institute to maintain routine testing practices at this institute. The National Veterinary Institute receives samples from all other animals-at-risk including clinically suspected animal for diagnosis and performs confirmatory testing on all samples where the results are initially positive or inconclusive. The confirmatory testing performed at the National Veterinary Institute are histopathology and immunohistochemistry. If a conclusive result is not obtained by those tests or the material is poor, the material is sent to the Community TSE reference laboratory in Weybridge, England which then performs further testing to reach the final conclusion.

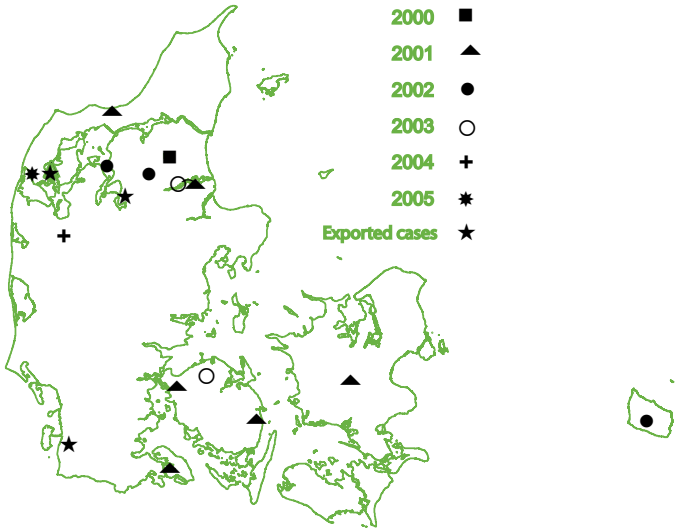


Figure 28. Geographical distribution of BSE positive herds in Denmark, 2000-2006. 3 cases were exported to other EU countries, two cases were detected in 2002 and one case was detected in 2003. There were no cases in 2006.

During 2006, Denmark tested a total of 200,962 normal slaughter animals above 30 months of age without finding any animals positive for BSE. A total of 38,309 fallen stock animals above 24 months were also tested, and none was found to be positive for BSE (Table A17). The geographical distribution of BSE positive herds identified from 2000-2006 is shown in Figure 28.

The National Veterinary Institute has developed a prediction model for the expected number of BSE cases in Denmark for the period 2007 to 2010. The current version of this model assumes a 100% effective feed ban as of January 2002, an assumption for which, to date, no validation data can be produced. According to this prediction, the eradication of BSE in Denmark has nearly been accomplished (Figure 29) which correlates well with the fact that 2006 was the first year since 1999 with no BSE cases in Denmark.

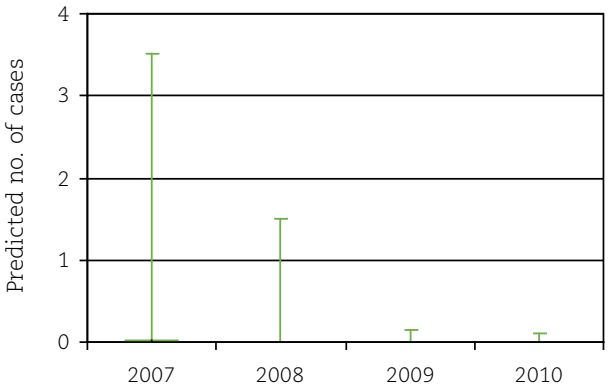


Figure 29. Predictions of the expected number of BSE cases (+confidence interval), 2007-2010.
Source: Vet-DTU

In 2005, OIE adopted a simplified model for BSE country classification. The model consists of the three categories: negligible risk, controlled risk and undetermined risk.

In 2006, a major amendment of the TSE regulation 999/2001 was adopted in the EU. The amendment formed the basis for the Commission to adopt the necessary adjustments to the annexes concerning country categorisations before the transitional measures in the TSE regulation runs out in July 2007. Further, the amendment was the first step towards a new BSE surveillance system in Europe, where Member States that fulfil certain conditions, among others a declining BSE prevalence, can apply for a less intensive surveillance programme to the Commission.

7.3 Sheep and goats

It has been demonstrated, that under experimental conditions sheep can contract BSE and there has been much concern that this may also occur under field conditions. In 2005, the first case of BSE in a goat was confirmed in France. In 2006, three sheep were suspected of being infected with BSE when tested using the rapid discriminatory test. The samples are still being analysed by mouse bioassays. Due to these four cases, two Commission Regulations amending the surveillance programme were adopted, and Member States had to test goats over 18 month (started in 2005) and sheep over 18 month at slaughter (started in the middle of 2006). The surveillance programme will be reviewed at the end of 2006.

As outlined in Table A18, all fallen stock older than 18 months of age were tested for TSE following the same procedure as was described for cattle. Brain stem material was used for testing in all cases. In cases where rapid tests showed positive or inconclusive results at one of the private laboratories, samples were subjected to confirmatory testing at the National Veterinary Institute, which employed histopathology and immunohistochemistry techniques to obtain conclusive results. If the result is positive, the National Veterinary Institute conducts an initial rapid discriminatory test, which can differentiate between BSE and other types of TSE so BSE may be excluded. This test is followed by the mouse bioassay if the result of the discriminatory testing is positive or inconclusive. It takes two years before there is a result with the mouse bioassay. Throughout Europe, the discriminatory testing has only been positive or inconclusive in the three cases described above. When the goat from France died in 2002 the only possible discriminatory test was the mouse bioassay.

During 2006, 4,290 sheep and goats were examined at slaughter under the new surveillance programme. A total of 5,470 fallen sheep and goats were tested in 2006 (Table A18). Three sheep were found to be positive for TSE, which was the first time TSE was recorded in Danish sheep or goats. All three cases were classified as atypical scrapie cases, which is expected to be a spontaneous TSE, although this is not scientifically proven. Genotyping of the three positive sheep was conducted according to the EU regulation No. 999/2001 (Table A19). Recording of atypical scrapie in Denmark was expected due to the aetiology of scrapie and the fact that the new test (IDEXX) used by the private laboratory from May 2006 has a high sensitivity towards atypical scrapie.

Denmark has a population of approximately 200,000 sheep and lambs. In the sheep population, some animals have a genotype that is resistant to classical scrapie. Although less conclusive, evidence also suggests that the same genotype is resistant to BSE. The pathogenic prion load in these resistant sheep is much lower than in non-resistant sheep. Therefore, the resistant sheep will pose a much lower public health risk, compared to that of non-resistant sheep. In 2006, like previous years, a study was conducted to determine the prion protein genotypes from a sample of ovine animals according to the EU regulation No. 999/2001 (as amended). The study consisted of 100 randomly selected animals. Results showed that 14% of sheep had the resistant prion protein genotype ARR/ARR (Table A20).

8. Other Zoonoses

8.1 *Brucella* spp.

Brucellosis is notifiable in animals, but not notifiable in humans. Hence, the incidence of brucellosis in humans is unknown.

Humans

In 2006, nine cases of brucellosis were identified by serological testing (Table A1). Seven persons were found to be positive for *B. abortus* and two persons for *B. melitensis*. Information about travel history (Taiwan and Poland) was available in one case with *B. abortus*. Furthermore, two cases were found positive for *Yersinia* O9, known to cross-react with *Brucella* spp. in the serological test; no clinical data were available for these cases.

Cattle

Abortion clusters in cattle are notifiable. In Denmark, the last outbreak with *Brucella* spp. was recorded in 1962 and Denmark has been officially brucellosis free since 1979. Monitoring is performed by serological analysis of 5-8 ml blood samples from the cows under suspicion. Bulls are subject to serological testing pre-entry to bovine semen collection centres and are thereafter examined annually for brucellosis (2,671 samples in 2006). Further, 4,606 samples were tested in relation to export and 332 samples were tested due to abortions suspected of being caused by *Brucella* infections. *Brucella* infections were not detected in any of the 7,609 samples tested in 2006 (Table A11).

Sheep and Goats

Denmark has been declared officially free of brucellosis in sheep and goats since 1995. Ovine and caprine *B. melitensis* has never been detected in Denmark. Monitoring is performed by testing for *Brucella* antibodies in 5-8 ml blood samples from sheep and goats which are submitted as part of a voluntary control programme for lentivirus (3,890 samples), in connection with import/diagnose (88 samples). In 2006, 3,978 samples were examined and found negative.

Pigs

Boars at porcine semen collection centres are subject to pre-entry serological testing for *Brucella suis*, with follow-up testing at least every 18 months, as well as prior to departure from these centres. Further, samples are collected in connection with export and fertility problems. In 2006, 23,064 samples were examined and found negative (Table A9). 6,781 samples were tested in relation to export, 243 samples due to fertility problems and 16,040 samples were from boars.

Occasionally *B. suis*, biotype 2, is recorded in pigs, latest in 1999. The last couple of outbreaks have been reported in outdoor pigs and it is believed that the hare population has a low prevalence of *Brucella* especially in Central Jutland.

8.2 *Chlamydia psittacci* (ornithosis)

Ornithosis is notifiable in humans and birds.

Humans

In 2006, seven human cases of ornithosis were reported (Table A1). The patients were between 33 and 70 years old; five were men and two women. Five of the patients have had known contact with birds. The infections were verified by PCR in all seven cases.

Birds

At the National Veterinary Institute, all domesticated birds submitted to the laboratory are screened for ornithosis. In 2006, nine birds were found positive for *C. psittacci*; seven parrots, one parakeet and one budgerigar.

8.3 *Leptospira*

Leptospirosis is notifiable in humans and animals.

Humans

In 2006, 15 human cases of leptospirosis, (13 men and 2 women) were diagnosed by serology (MAT test) (Table A1). One patient died presenting multi-organ failure as a complication from a severe infection. The remaining patients recovered. As in previous years, *Leptospira interrogans* serovar icterohaemorrhagiae accounted for 25% of the infections, while the remaining were caused by a

number of serovars including sejrø, patoc, saxkøbing, poi, hurstbridge and bratislava. Seven cases were reported in August-September, four cases in January-July and four cases in November-December. All cases, except one who had travelled in Thailand, were infected in Denmark and several patients had directly or indirectly been exposed to rat excretments.

Farm animals

In farm animals, suspicion of leptospirosis is often based on increased incidence of abortions or other reproductive problems in a herd. In 2006, a total of 114 samples, mainly from swine, were investigated by immunoflourescence techniques and *Leptospira* was detected in two samples from a case of abortion in a pig herd localized in Jutland.

8.4 *Mycobacterium bovis/tuberculosis*

Mycobacterium bovis is notifiable in humans and animals.

Humans

In 2006, three cases (0.05 case per 100,000 inhabitants) of human tuberculosis caused by *M. bovis* were reported (Table A1). All cases were elderly people. Their disease may have been caused by reactivation of latent infections acquired before the eradication of bovine tuberculosis in cattle.

Animals

Danish cattle herds have been declared officially tuberculosis free since 1980. Meat inspectors at the slaughterhouses monitor for the presence of TB lesions in slaughtered cattle. In 2006, no positive cases were observed (Table A11). The last case of TB in cattle was diagnosed in 1988. At semen collection centres, bulls are subject to pre-entry and annual intradermal tuberculin testing.

Slaughter pigs are monitored for the presence of TB lesions by the meat inspectors at slaughter as well. In 2006, no positive cases were observed (Table A9).

M. bovis has not been detected in deer in Denmark since 1994.

8.5 *Cryptosporidium* spp.

Cryptosporidiosis is not notifiable and therefore little information is available concerning the incidence in humans and animals.

Humans

Two species of *Cryptosporidium*, the zoonotic species *C. parvum* and the anthroponotic species *C. hominis*, are responsible for the majority of human infections. At most diagnostic laboratories in Denmark, only patients with persistent diarrhoea or a history of recent travel are examined for cryptosporidiosis. In 2006, 25 sporadic cases (37 positive samples) from 6,615 samples examined, were reported (Table A1). Approximately 90% of the diagnosed infections are acquired from travel abroad.

Animals

Mammalian samples submitted to the National Veterinary Institute for routine parasitological analysis, were screened for *Cryptosporidium* using immunofluorescence detection and/or a modified Ziehl-Neelsen technique. In 2006, 1,015 faecal samples from cattle were analysed and 19.6% were positive for *Cryptosporidium*. Samples from dogs and cats with diarrhoea were positive for *Cryptosporidium* in 16.7% and 6.2% of the cases, respectively (Table A15). Among samples from other animal species submitted to the National Veterinary Institute for diagnosis, the occurrence of *Cryptosporidium* did not exceed 2%. However, lemurs posed an exception as 14% of the samples submitted from these zooanimals contained *Cryptosporidium* spp. oocysts.

Cryptosporidium genotyping is not offered as a routine diagnostic tool in Denmark, but can be performed upon request.

8.6 *Echinococcus granulosis/multilocularis*

Echinococcus granulosus/multilocularis is notifiable in animals, but not in humans. Hence, the human incidence of *echinococcosis* is unknown.

Humans

In 2006, 10 cases were reported (Table A1). All cases were infected with *E. granulosus* and reported travelling abroad.

Animals

Surveillance for *E. granulosus* is performed as part of the routine meat inspection at the slaughterhouse. There were no findings in 2006. No foxes were tested specifically for *E. multilocularis* at the National Veterinary Institute in 2006.

8.7 *Toxoplasma gondii*

Toxoplasma gondii infection is not notifiable in Denmark and therefore little information is available concerning the incidence in humans and animals.

Since 1999 a nationwide neonatal screening system for congenital toxoplasmosis has been carried out. In 2006, 67,131 newborns were tested, 14 were positive. Since the onset of the screening between 8 and 19 cases have been reported annually.

8.8 *Trichinella* spp.

Trichinella spp. is notifiable in animals, but not in humans. Hence, the human incidence of trichinosis is unknown.

Humans

Indigenous human cases have not been verified for decades in Denmark and in 2006, no positive cases were reported (Table A1).

Anmals

Since 1930, *Trichinella* spp. has not been recorded in pigs in Denmark and in 2006 there were no positive findings in the 21,106,788 slaughter pigs, 1,324 wild boars and 1,272 horses examined.

EU Regulation 2075/2005 came into force in 2006. In accordance with this regulation all finishers, sows, boars, horses, wild boars and some other wild species must be tested for *Trichinella* spp. at slaughter. The regulation opens for the possibility to apply for status as region with negligible risk of trichinosis among pigs. Denmark has submitted such an application and this is under consideration in the EU. Until EU decides the Danish status, pigs slaughtered at slaughterhouses not approved for export are not examined for *Trichinella* spp. just like in previous years. If Denmark is given the status as having negligible risk of *Trichinella* spp. in pigs the testing for *Trichinella* spp. in slaughter pigs can be carried out after risk based principles.

Samples from pets, zoo animals and wildlife are only tested for *Trichinella* spp. on request. In 2006, no positive samples were recorded.

8.9 *Lyssavirus* (Rabies)

Rabies is notifiable in humans and in animals.

Humans

No human cases of rabies were reported in 2006 (Table A1), however, five people underwent prophylactic treatment following bites from bats. In two of these cases the bats were examined and one was found positive for European Bat Lyssavirus (EBLV). In addition, 74 people were treated by prophylactic vaccination following exposure abroad to bites from animals with risk of being infectious.

Animals

Sylvatic rabies was last recorded in Denmark in 1982 when a cow near the southern border was infected.

European Bat *Lyssavirus* (EBLV) was first recorded in Denmark in 1986 and has been recorded nearly every year since then (Table 6). In 2006, 33% of the bats submitted for analysis was positive for EBLV, which was an increase compared to previous years. From one colony, nine bats were submitted for analyses and 4 were found positive suggesting that the infection may appear in epidemics.

Table 6. Number of bats examined and found positive for European Bat Lyssavirus in Denmark, 1986-2006.

	N	Positive	% positive
1986	552	105	19.0
1987	449	49	10.9
1988	38	0	0
1989	15	1	6.7
1990	7	0	0
1991	7	0	0
1992	3	0	0
1993	13	1	7.7
1994	4	1	25.0
1995	2	1	50.0
1996	2	0	0
1997	31	11	35.5
1998	45	10	22.2
1999	88	9	10.2
2000	38	2	5.3
2001	20	2	10.0
2002	43	3	7.0
2003	32	3	9.4
2004	18	2	11.1
2005	15	0	0
2006	45	15	33.3

Source: Vet-DTU

8.10 *Coxiella burnetii* (Q fever)

Q fever is notifiable in animals, but not notifiable in humans. Hence, the incidence in humans is not known.

Q fever is a zoonotic disease caused by *Coxiella burnetii*, a species of bacteria that is distributed globally. Cattle, sheep and goats are the primary reservoirs of *C. burnetii*. Normally these animals show no clinical signs although abortion in goats and sheep has been observed. In infected animals high numbers of bacteria are shed with the am-

niotic fluids and the placenta during birth and abortions. A lower number of bacteria are excreted in milk, urine and faeces of infected animals. Humans are often very susceptible to the disease, and the infectious dose is low. Usually, humans become infected after inhaling organisms from air containing airborne barnyard dust contaminated with amniotic fluids, placental material or excreta from infected animals.

Humans

The disease has only recently been acknowledged as a zoonotic problem in Denmark. I 2006, 47 patients were found to be seropositive for antibodies against *C. burnetii*. Of these, 17 showed serological signs of acute infection. Two patients were reported to have a history of travelling abroad, and 29 reported exposure to Danish domestic animals known to be infected with C. burnetii. Infections with *C. burnetii* during pregnancy may cause abortion and premature birth in humans. One pregnant woman with known exposure to *C. burnetii* had serological signs of an acute infection. She was treated with antibiotics during the remaining part of the pregnancy and delivered a healthy baby at term.

Animals

Since 1989, blood samples from cattle, mainly for export markets, have been tested for antibodies against *C. burnetii* at the National Veterinary Institute. Between 1989-2003, 0-4% of the examined animals was positive (Table 7). However, in the last three years the percentage of positive samples from export cattle has increased to 7-11%. There is no explanation for this increase. Since 2005 more focus has been put into diagnosis of samples from animals under suspicion of having the disease, and 15.0% and 27.5% of these samples were positive in 2005 and 2006, respectively. Further, a newly developed fluorescence in situ hybridisation method (FISH) was used to analyse tissue samples from the afterbirth of diagnostic cases in 2006. Fourteen samples were analysed, two samples were positive.

From 1992-94, a small number of sheep and goats meant for export were analysed, none of the samples were positive. Further, a few diagnostic samples were analysed in 2005-06 all of which were negative.

Table 7. Serological analysis of* Coxiella burnetii *in cattle, 1989-2006[a]. From 1989-2004, mainly analysis carried out on animals for the export market.

	N	Pos	% pos
1989	684	2	0.3
1990	595	6	1.0
1991	102	0	0.0
1992	53	2	3.8
1993	14	0	0.0
1994	175	4	2.3
1995	348	4	1.1
1996	735	0	0.0
1997	814	11	1.4
1998	473	6	1.3
1999	837	30	3.6
2000	396	7	1.8
2001	6	0	0.0
2002	337	0	0.0
2003	225	8	3.6
2004	102	7	6.9
2005 - Diagnostic	187	28	15.0
2005 - Export	9	1	11.1
2005 - Breeding stock	23	2	8.7
2006 - Diagnostic	211	58	27.5
2006 - Export	14	1	7.1
2006 - Breeding stock	11	0	0.0

[a] From 1989-2004 the complement binding method (CFT) was used, in 2005-2006 an ELISA test was used.
Source: Vet-DTU

Cowpox virus detected in Denmark

A recent review of laboratory records using electron microscopy and PCR techniques revealed a human case from 1998 positive for Cowpox virus of the genus *Orthopoxvirus*. In 2006, a second human case was diagnosed.

In spite of its name, the natural hosts of cowpox virus are rodents and cats, and they are probably the most frequent source of cowpox virus infection in humans. A serological survey in cats submitted for other diagnostic purposes showed that the prevalence of cowpox virus in cats in Denmark is low compared to other European countries with <5% of cats positive. As the two cases in humans reported hitherto due to their clinical manifestations involved admission to hospital, it must be assumed that human cases in Denmark are underreported.

Appendix

Data tables

Table A1. Zoonoses in humans, number of cases over a ten year period.

	Incidence per 100,000	Registered no. of cases						
Zoonotic pathogen	2006	2006	2005	2004	2003	2002	2001	1997
Bacteria								
Brucella abortus/melitensis [a, d]	-	9	15	4	14	16	18	-
Campylobacter coli/jejuni [b]	59.7	3,242	3,671	3,724	3,536	4,379	4,620	2,666
Coxiella burnetii [a]	-	47	-	-	-	-	-	-
Leptospira spp. [b]	0.3	15	24	33	13	13	6	9
Listeria monocytogenes [b]	1.0	56	46	41	29	28	38	33
Mycobacterium bovis [b]	<0.1	3	0	2	1	2	4	11
Chlamydia psittaci [b]	0.1	7	22	8	14	13	9	-
Salmonella spp. [b]	30.5	1,658	1,775	1,538	1,712	2,071	2,918	5,015
S. Enteritidis [b]	10.3	562	642	546	735	1,105	1,416	3,674
S. Typhimurium [b]	7.6	411	565	467	449	382	589	841
Other serotypes [b]	12.6	687	568	525	528	584	913	500
VTEC total [b]	2.7	146	154	168	128	143	90	33
O157	0.3	19	25	47	27	23	24	12
other or non-typeable	2.3	127	129	121	101	120	66	21
Yersinia enterocolitica [b]	4.0	215	241	228	243	240	286	430
Parasites								
Cryptosporidium spp. [a, d]	-	25	-	-	-	-	-	-
E. multilocularis [a]	-	0	-	-	-	-	-	-
E. granulosus [a]	-	10	-	-	-	-	-	-
Toxoplasma gondii [a,c]	-	14	9	8	13	12	19	-
Trichinella spp. [a,d]	-	0	-	-	-	-	-	-
Viruses								
Rabies [b]	0	0	0	0	0	0	0	0

[a] Not notifiable hence the incidence cannot be calculated.

[b] Notifiable.

[c] Nation-wide neonatal screening for congenital toxoplasmosis; 67.131 newborns tested in 2006.

[d] Data presented are from one laboratory (SSI) only, representing a proportion of the Danish population (approximately 1/3 in 2006). The proportion of the population represented varies from year to year, thus results from different years are not comparable. Testing for these pathogens is carried out only if specifically requested on the submission form.

Source: SSI

Appendix

Table A2 Phagetype distribution (%) of S. Enteritidis from humans, animals and imported meat, 2006.

	Human n=525	Layer flocks[b] n=1	Broiler flocks[c] n=2	Import[d] Chicken n=23
PT 8	23.0	100	0	0
PT 4	16.8	0	0	65.2
PT 1	13.5	0	50.0	0
PT 21	10.1	0	0	17.4
PT 6	6.5	0	50.0	4.3
PT 35	1.0	0	0	4.3
PT 12	0.2	0	0	9
Others	29.0	0	0	0
TOTAL	100	100	100	100

Footnotes: See Table A4.

Source: DVFA, SSI and National Food Institute

Table A3. Phagetype distribution (%) of S. Typhimurium from humans, animals and imported meat, 2006.

			Broiler	Imported meat[d]				
	Human n=353	Pork[a] n=49	flocks[c] n=10	Pork n=15	Beef n=2	Chicken n=2	Turkey n=11	Duck n=3
DT 104	22.1	12.2	0	33.3	0	0	63.6	0
DT 12	5.1	10.2	0	0	0	0	0.0	0
DT 120	15.6	22.4	0	0	50.0	0	9.1	0
DT 170	2.3	14.3	30.0	0	0	0	0	0
DT 193	3.4	0	0	13.3	0	0	0	0
DT 40	2.0	0	0	0	0	0	0	33.3
DT 41	0.8	0	30.0	0	0	0	0	0
NT	8.2	10.2	0	33.3	50.0	100	9.1	0
Others	40.5	30.6	40.0	20.0	0	0	18	66.7
TOTAL	100	100	100	100	100	100	100	100

Footnotes: See Table A4.

Other phagetyped S. Typhimurium isolates: 1 Beef isolate (DT12).

Source: DVFA, DFVF and SSI

Table A4. Serotype distribution (%) of Salmonella *from humans, animals carcasses at slaughterhouse and imported meat, 2006. In some cases more than one serotype was found per positive herd/carcasses/batch and therefore the number of typed units may be greater than the number of positive herds/carcasses/batches.*

				Layer	Broiler	Duck	Imported meat[d]				
	Human n=1658	Pork[a] n=155	Beef[a] n=13	flocks[b] n=1	flocks[c] n=86	flocks[c] n=185	Pork n=58	Beef n=4	Chicken n=57	Turkey n=72	Duck n=7
Enteritidis	34.0	0	0	100	2.3	0	0	0	40.4	0	0
Typhimurium	24.8	41.3	15.4	0	17.4	0	50.0	50.0	3.5	20.8	42.9
Newport	3.4	0	0	0	0	0	0	0	0	8.3	0
O:4,5,12; H:i:-	2.0	1.3	0	0	0	0	5.2	0	0	0	0
Virchow	2.0	0	0	0	0	0	0	0	0	6.9	0
Infantis	1.9	5.2	0	0	14.0	0	3.4	0	17.5	0	0
Dublin	1.6	1.3	76.9	0	0	0	0	0	0	0	0
Agona	1.4	0	0	0	2.3	0.3	0	0	1.8	2.8	0
Hadar	1.1	0.6	0	0	0	0	0	0	3.5	30.6	0
Saintpaul	1.0	0	0	0	0	0	0	0	0	11.1	0
Kottbus	0.8	0	0	0	0	16.9	0	0	0	1.4	0
Montevideo	0.7	0	0	0	0	0	0	0	0	1.4	0
Muenchen	0.7	0	0	0	0	0	0	25.0	0	0	0
Anatum	0.7	0	0	0	0	19.5	1.7	0	0	0	0
Kentucky	0.5	0	0	0	4.7	0	0	0	0	0	14.3
Derby	0.4	22.6	0	0	12.8	0	17.2	0	5.3	2.8	0
Indiana	0.1	0	0	0	4.7	12.3	0	0	14.0	1.4	42.9
Others	22.9	27.7	7.7	0	41.9	51.1	22.4	25.0	14.0	12.5	0
Total	100	100	100	100	100	100	100	100	100	100	100

[a] Swab samples of pork and beef carcasses from the surveillance programme at slaughterhouses.

[b] Represenative samples from the surveillance programme in prodution flocks.

[c] Representative faecal or sock samples from the mandatory AM inspection prior to slaughter.

[d] Monitoring of imported meat and meat products.

Source: DVFA, DFVF and SSI

Table A5. Occurrence of **Salmonella** *in the table-egg production, 1996-2006.*

	Central rearing		Adult breeders		(Pullet) rearing		Layers	
	N	Positive	N	Positive	N	Positive	N	Positive
1996							442	13
1997	15	2	33	5	96	26	431	60
1998	21	0	42	0	375	11	700	97
1999	14	0	26	1	422	10	718	37
2000	15	0	29	0	374	8	688	32
2001	14	0	22	0	339	5	607	35
2002	15	0	22	0	330	9	619	16
2003	24	0	15	0	367	4	611	14
2004	9	2	9	0	368	1	641	5
2005	16	0	9	0	255	6	658	7
2006	17	0	11	0	289	2[a]	565	2[b]

[a] One Flock positive with *S.* Typhimurium DT193 and one flock was serological positive

[b] One flock positive with *S.* Enteritidis and one flock was serological positive

Source: DVFA

Table A6. Occurrence of **Salmonella** *in the broiler production, 1996-2006.*

	Adult breeders Flocks		Broilers Flocks		Slaughterhouse Flocks/Batches	
	N	Positive	N	Positive	N	Positive
1996			3,963	331		
1997	408	8	4,139	534	4,378	749
1998	344	2	4,166	271	4,985	553
1999	361	2	4,716	165	5,117	338
2000	345	3	4,567	95	4,543	132
2001	325	7	4,504	68	1,695[a]	69
2002	330	2	4,378	66	1,667	91
2003	182	4	4,385	75	1,552	77
2004	155	6	4,313	66	1,472	24
2005	60	0	4,083	84	1,174	27
2006	53	2	3,640	79	775[b]	15

[a] AM sampling at the slaughterhouse were changed from pooled neck skin samples of flocks to chicken cuts sampling of batches

[b] From 2006, data cover only samples taken following the *Salmonella* programme set up in the legislation (Table A22). Verification samples taken once a week by producers of poultry meat approved to market *Salmonella*-free poultry meat are not included, this sampling started in middle of 2005.

Source: DVFA and DMA

Table A7. Occurrence of **Campylobacter** *in the broiler production, 2006.*

	Broilers Flocks		Non-heat treated broiler meat Samples	
	N	Positive	N	Positive
Danish	4,595[a]	1,375	1563[b]	183
Imported	-	-	1181[b]	614

[a] Flocks investigated by cloacal swabs collected at slaughter, 10 samples/flock pooled and analysed as 1 sample using PCR.

[b] Centrally co-ordinated studies.

Source: DVFA and DMA

Table A8. Occurrence of **Salmonella** *and* **Campylobacter** *in the turkey production, 2006*[a].

	Flocks		Non-heat treated turkey meat Samples	
	N	Positive	N	Positive
Salmonella				
Danish	32[b]	0	-	-
Campylobacter				
Danish	-	-	9	2
Imported	-	-	573	164

[a] From 2004, commercially raised turkeys were no longer slaughtered in Denmark.

[b] Flocks monitored by sock samples 2-3 weeks prior to slaughter and by end-product samples after slaughter.

Source: DVFA and DMA

Appendix

Table A9. Occurrence of zoonotic pathogens in pigs and pork in Denmark, 2006.

	Primary production			Slaughterhouse (slaughtering >50 pigs pr month)		Slaughterhouse (slaughtering 50 or less pigs pr month)	
Zoonotic pathogen	Herds N	Herds Positive	Animals N	Samples N	% Positive	Samples N	% Positive
Bacteria							
Salmonella spp.							
Danish	11,239[a]	386[a]	-	27,892[b]	0.9[c]	121[b]	0[c]
Campylobacter spp.							
C. jejuni	-	4	-	-	-	-	-
C. coli	-	150	-	-	-	-	-
Other serotypes	-	0	-	-	-		-
TOTAL	295	154	295[d]	-	-	-	-
Brucella abortus		0	23,064[e]	-	-	-	-
Mycobacterium bovis	-	0	21,106,788[f]	-	-	-	-
Parasites							
Trichinella spp.	-	0	21,106,788[g]	-	-	-	-

[a] Data are from December, 2006. Herds monitored using serological testing. Herds belonging to level 2 and 3 were defined as *Salmonella* positive.

[b] Swaps from three areas of the half-carcass were collected at the slaughterhouse. Samples from 5 animals were pooled, except at slaughterhouses where 50 pigs or less were slaughtered per month, in which case samples were analysed induvidually.

[c] When estimating the prevalence of *Salmonella*, both the loss of sensitivity and the probability of more than one sample being positive in each pool are taken into consideration. A conversion factor has been determined on the basis of comparative studies, as described in Annual Report 2001

[d] Caecal content was tested from one animal per herd; collected at slaughter (DANMAP programme).

[e] Including samples from boars (examined at pre-entry, every 18 month, and prior to release from semen collection centres), samples collected in connection with export or fertility problems. Samples were analysed using either the SAT, RBT, CFT or ELISA methods

[f] Slaughtered pigs were examined by slaughterhouse meat inspectors.

[g] Samples from pigs slaughtered at export approved slaughterhouses were examined using the method described in Directive 2075/2005/EEC.

Source: DVFA, Vet-DTU and National Food Institute, DTU

Table A10. Cattle herds assigned to level 1-3 according to the S. Dublin surveillance, January 2007.

Salmonella Dublin level		Non-milk producing herds		Milk producing herds	
		N	%	N	%
Level 1					
1a	On the basis of milk samples	736		4,325	
1b	On the basis of blood samples	14,136		24	
Total	Probably Salmonella Dublin free	14,872	77.5	4,349	83.7
Level 2					
2	Titer high in blood- or milk samples	426		730	
2	Contact with herds in level 2 or 3	942		98	
2	'Non-Level 1' due to too few blood samples	5		1	
Total	Non Salmonella Dublin free	1,373	7.2	829	16.0
Level 3					
Total	Salmonellosis, official supervision	3	<0.1	11	0.2
Unknown	Too few blood samples	2,931	15.3	4	0.1
TOTAL		19,179		5,193	

Source: DVFA

Table A11. Occurrence of zoonotic pathogens in cattle and beef in Denmark, 2006.

	Primary production			Slaughterhouse (slaughtering >50 cattle pr month)		Slaughterhouse (slaughtering 50 or less cattle pr month)	
Zoonotic pathogen	Herds N	Herds Positive	Animals N	Samples N	% Positive	Samples N	% Positive
Salmonella spp.							
Danish	-	-	-	8,005[b]	0.3[c]	191[b]	0[c]
Campylobacter spp.							
C. jejuni	-	84	-	-	-	-	-
C. coli	-	15	-	-	-	-	-
Other species	-	0	-	-	-	-	-
TOTAL	224	99	224[a]	-	-	-	-
Brucella abortus	-	0	7,609[d]	-	-	-	-
Mycobacterium bovis	-	0	489,470[e]	-	-	-	-
VTEC 0157	194	20	194[a]	-	-	-	-

[a] Caecal content was tested from one animal per herd, collected at slaughter (DANMAP programme).
[b] Swaps from three areas of the half-carcass were collected at the slaughterhouse. Samples from 5 animals were pooled, except at slaughterhouses slaughtering 50 or less pigs per month where samples are analysed individually.
[c] When estimating the prevalence of *Salmonella*, both the loss of sensitivity and the probability of more than one sample being positive in each pool are taken into consideration. A conversion factor has been determined on the basis of comparative studies, as described in Annual Report 2001
[d] Including samples from bulls (examined upon admission to semen collection centres, and annually hereafter), samples collected in connection with export or suspiciuos abortions. Samples were analysed using either the SAT, RBT or CFT methods.
[e] Slaughtered cattle were examined by the slaughterhouse meat inspectors.
Source: DVFA, Vet-DTU and National Food Institute, DTU

Table A12. Number of* Salmonella *positive batches obtained from imported meat, 2006.

	Batches examined	Batches positive	Positive for DT104
Chicken	188	34	1
Turkey	133	26	2
Pork	225	40	1
Beef	208	2	2
Other	100	12	1
TOTAL	854	114	7

Source: DVFA

Table A13. Control of* Salmonella *in compound feeds, feed processing and feed materials in 2006.

	2006 Samples		2005 Samples		2004 Samples		2003 Samples		2002 Samples	
	N	Pos	N	Pos	N	Pos	N	Pos	N	Pos
Feed processing plants (process control):										
Ordinary inspections	1,589	31[a]	1,885	29	2,008	30	2,409	34	2,740	33
Additional inspections	174	13	175	15	156	21	241	46	262	48
Feed materials, farm animals	336	16[b]	1,119	72	1,127	49	144	2	269	5
Transport vehicles, hygiene samples	191	2[c]	254	3	317	3	-	-	-	-

[a] S. Agona, S. Barranquilla, S. Cubana, S. Derby, S. Havana, S. Idikan, S. Kentucky, S. Kralingen, S. Lexington, S. Lille, S. Liverpool, S. Livingstone , S. Meleagridis, S. Putten, S. Rissen, S. Senftenberg, S. Typhimurium DT99
[b] S. Derby, S. Havana, S. Infantis, S. Kralingen, S. Livingstone, S. Mbandaka, S. Montevideo, S. Putten, S. Swarzengrund, S. 3,10:e,h:-
[c] S. Cerro, S. Putten
Source: PD

Appendix

Table A14. Serotype distribution (%) of Salmonella from rendering plants, 2006.

Serotype	% samples[a] n= 238
S. Livingstone	34.0
S. Kentucky	11.8
S. Havanna	9.7
S. Montevideo	5.9
S. Senftenberg	5.5
S. 4:12:b:-	4.6
S. Anatum	1.7
S. Cubana	1.3
S. Tennesee	1.3
S. Derby	0.8
S. Infantis	0.8
S. llandorf	0.8
S. Banana	0.4
S. London	0.4
S. Mbandaka	0.4
S. Ohio	0.4
S. Parathyphii	0.4
S. Poona	0.4
S. Putten	0.4
S. Typhimurium	0.4
S. rough	3.8
Not typable	14.7
TOTAL	100

[a] Samples are analysed using the NMKL-method no. 71 combined with a ELISA method (Bio Line)

Source: DVFA

Table A16. VTEC O-group distribution in humans, 2006. All O-groups that resulted in five or more episodes are listed.

O-group	Number of episodes
O157	19
O103	18
O26	13
O117	12
O128	9
O146	8
O145	7
O91	6
O121	5
O111	5
Other O-groups	35
TOTAL	137

Source: SSI

Table A15. Occurrence of zoonotic pathogens in pets, zoo animals and wild life in Denmark,

	Pet animals						Zoo animals				Wildlife			
	Dog		Cat		Others		Mammal & reptiles		Birds		Mammal		Birds	
Zoonotic pathogen	N	positive	N	positive	N	positive	N	positive	N	positive	N	positive	N	positive
Salmonella spp.														
S . Enteritidis	-	-	-	-	-	-	-	-	-	-	-	8[f]	-	-
S. Typhimurium	-	-	-	-	-	-	-	1[b]	-	1[d]	-	-	-	-
Others	-	-	-	-	-	1[a]	-	5[c]	-	1[e]	-	-	-	-
TOTAL	41	0	8	0	15	1	94	6	81	2	163	8	15	0
Campylobacter spp.														
C. *upsaliensis*	-	4	-	2	-	-	-	-	-	-	-	-	-	-
Others	-	9	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	28	13	2	2	-	-	6	0	-	-	-	-	-	-
Cryptosporidia spp.	65	11	18	1	3	1[g]	76	9[h]	3	0	-	2[i]	-	-

[a] Snake: S. Muenchen
[b] Tiger kitten
[c] One marmoset: S. Crewe, one hedgehog: S. Apapa, two boas: S. Muenchen, one snake: S. Newport
[d] Loris
[e] Spoonbill: S. Thompson
[f] European hedgehog
[g] Chinchilla
[h] Lemur
[i] Hedgehog

Source: VET-DTU

Table A17. BSE surveillance programme for cattle, 2006.

Type of surveillance	N	Positive
Active surveillance		
Healthy slaughtered animals (>30 month)	200,962	0
Risk categories:		
Emergency slaugthers (>24 month)	1,747	0
Slaughterhouse ante-mortem inspection revealed suspicion or signs of disease (>24 month)	5	0
Fallen stock (>24 month)	38,309	0
Animals imported from the UK	1	0
Animals from herds under restriction	3	0
Passive surveillance		
Animals suspected of having clinical BSE	4	0
TOTAL	241,031	0

Source: DVFA

Table A18. The TSE surveillance programme for sheep and goats, 2006.

Type of Surveillance	N	Positive
Active surveillance		
Fallen stock (>18 mo.)	5,470	2
Healthy slaughtered animals (>18 mo.)	4,290	1
Passive surveillance		
Animals suspected of having clinical TSE	4	0
TOTAL	9,764	3

Source: DVFA

Table A19. Prion protein genotype of three sheep positive for atypical scrapie , 2006.

Genotype	N
AHQ/AHQ	2
AHQ/ARQ	1
TOTAL	3

Source: Vet-DTU

Table A20. Distribution (%) of prion protein genotype of sheep randomly selected, 2006.

Genotype	Sheep n=100
ARR/ARR	14.0
ARR/AHQ	1.0
ARR/ARQ	14.0
ARR/VRQ	1.0
AHQ/AHQ	2.0
AHQ/ARH	1.0
AHQ/ARQ	7.0
ARH/ARH	1.0
ARH/ARQ	2.0
ARQ/ARQ	51.0
ARQ/VRQ	6.0
TOTAL	100

Source: Vet-DTU

Appendix

Table A21. Overview of human and animal notifiable and non-notifiable diseases (reported herein) in Denmark, 2006, with reference to the relevant legislation.

	Notifiable in humans	Notification route	Notifiable in animals	EU legislation	Danish legislation
BACTERIA					
Brucella spp.	no	-	1920[i] OBF in 1979[f], no cases since 1962.	Cattle - Decision 2004/320/EEC	Order no 305 of 3/5 2000
			Never detected, ObmF in 1995[g]	Sheep and goats - 2004/320/EEC	Order no. 739 of 21/8 2001,
			-	Pigs - Directive 2003/99/EEC	Order no. 215 of 18/3 1997
Campylobacter spp.	1979[a]	Lab[b]	no	-	
Chlamydophila psittaci (Ornithosis)	1980[a]	Physician[c]	yes	-	Poultry - order no. 78 of 30/1 1997
Listeria monocytogenes	1993[a]	Physician	no	-	-
Leptospira spp.	1980[a]	Physician	yes	-	Act no. 432 of 09/06/2004
Mycobacterium bovis/ tuberculosis	1905[a]	Physician (and lab[d])	1920[i] OTF since 1980[h]	Cattle - Decision 2004/320/EEC	Cattle - Order no. 306 of 3/5 2000
Coxiella burnetii	no		2005	-	Act no. 432 of 09/06/2004
Salmonella spp.	1979[a]	Lab	1993[e]	-	Cattle/swine - Order no. 112 of 24/02/2005 Poultry - Order no. 1010 of 24/10/2005
VTEC	2000[a]	Physician and Lab	no	-	-
Yersinia enterocolitica	1979[a]	Lab	no	-	-
PARASITES					
Cryptosporidium spp.	no	-	no	-	-
Echinococcus multilocularis	no		2004	-	-
Echinococcus granulosus	no	-	1993	-	Act no. 432 of 09/06/2004
Toxoplasma gondii	no	-	no	-	-
Trichinella spp.	no	-	1920[i]	Regulation 2075/2005	Circular no. 9466 of 12/07/2006
VIRUSES					
Lyssa virus (Rabies)	1964[a]	Telephone and physician	1920		Order no. 14 of 11/01/1999 and Order no. 914 of 15/12/1987
PRIONS					
TSE	-	-	yes	Sheep & goats - Regulation 999/2001 (as amended)	Order no. 930 ot 07/09/2006
BSE	-	-	yes	Cattle - Regulation 999/2001 (as amended)	Order no. 800 of 13/07/2006
BSE/Creutzfeld Jacob	1997[a]	Physician	-	-	-

[a] Danish order no. 277 of 14/04/2000. Cases must be notified to the Statens Serum Institut

[b] The regional microbiological laboratories report confirmed cases.

[c] The physician report individually notifiable infections.

[d] The laboratories voluntarily report confirmed cases.

[e] Only clinical cases notifiable.

[f] OBF according to Council Directive 64/432/EEC as amended by Council Directive 97/12/EC and Commision Decisions 93/52/EEC, 2003/467/EC and 2004/320/EC.

[g] ObmF according to Council Directive 91/68/EEC and Commision Decisions 93/52/EEC, 94/877/EEC, 2003/467/EC and 2004/320/EC.

[h] OTF according to Council Directive 64/432/EEC as amended by Council Directive 97/12/EC and regulation (EC) 1226/2002, and Commission Decision 2003/467/EEC.

[i] Clinical cases, observations during the meat inspection at the slaughterhouse, positive blood sampes or finding of agens are notifiable.

Source: DVFA and SSI

Table A22. **Salmonella** *surveillance of the broiler and table-egg production, 2006.*

Broiler and Table egg production			
Rearing breeding flocks		*Grandparent generation*	*Parent generation*
Time	Sample taking	Material	Material
Day-old	Per delivery	10 samples of crate material and 20 dead chicks[a]	10 samples of crate material and 20 dead chicks [a]
1st week	Per unit[g]	-	40 chicks
2nd week	Per unit	-	2 pairs of sock samples
4th week	Per unit	60 faecal samples[a]	60 faecal samples[a]
8th week	Per unit	2 pairs of sock samples	2 pairs of sock samples
2 weeks prior to moving	Per unit	60 faecal samples[a]	2 pairs of sock samples [a] and 60 blood samples
Adult breeding flocks		*Grandparent generation*	*Parent generation*
Time	Sample taking	Material	Material
Every two weeks	Per flock	250 meconium samples or 50 dead chickens collected at the hatchery[a,b]	250 meconium samples or 50 dead chickens collected at the hatchery[a,b]
Every week	Per unit	-	2 pairs of sock samples[c]
Hatchery		*Grandparent generation*	*Parent generation*
Time	Sample taking	Material	Material
After each hatching	Samples from 1-4 hatchers may be pooled	At least 25 grams of wet dust per hatcher	At least 25 grams of wet dust per hatcher

Broiler production		
Time	Samples taken	Material
2-3 weeks before slaughter - Ante mortem (AM)	Per flock	5 pairs of sock samples
After slaughter Post mortem (PM)	Per batch	AM-negative batches: 4 pooled samples of 10 chicken cuts[d] AM-positive batches: 12 pooled samples of 5 chicken cuts[d]

Table egg production		
Pullet-rearing flocks		
Time	Sample taking	Material
Day-old	Per delivery	10 samples of crate material and 20 dead chicks
Week 3	Per flock	5 pairs of sock samples or 300 faecal samples, if sock samples cannot be collected. Flocks of less than 200 birds: 2 pairs of sock samples or 60 faecal samples
Week 12	Per flock	Flocks of 500 or more birds: 60 blood samples and 5 pairs of sock samples or 300 faecal samples of sock samples cannot be collected[e] Flocks of 200-499 birds: 55 blood samples and 5 pairs of sock sample[e] Flocks of less than 200 birds: Blood samples[f] and 2 pairs of sock samples or 60 faecal samples[e]
Production for certified packing stations		
Time	Sample taking	Material
Every 9 weeks	Per flock	Egg samples[f] and 2 pairs of sock samples or faecal samples, equal to the number of eggs, if sock samples cannot be collected
Barnyard and hobby flocks		
Time	Sample taking	Material
3 times a year	Per flock	Egg samples[f]

[a] Requirements of the Zoonosis Directive (92/117/EEC).

[b] Samples collected by the RVFCA every 8 weeks.

[c] Samples collected by the RVFCA every 3 month.

[d] Requirements of the Commission Regulation (92/1538EEC).

[e] Samples collected by the RVFCA.

[f] According to Table 1 in Governmental Order No. 44, Jan 23rd 2003.

[g] A unit (house) may harbor part of a flock or more than one flock, depending on the size of the unit.

Source: DVFA

Appendix

Table A23. **Salmonella** *surveillance of the pig production, 2006.*

Breeding- and multiplier herds

Time	Sample taken	Purpose
Every month	10 blood samples per epidemiological unit	Calculation of *Salmonella* -index
Max. twice per year	Herds with *Salmonella* -index 5 or above: Pen-faecal samples	Clarify distribution and type of infection in the herd

Sow-herds

Time	Sample taken	Purpose
When purchaser of piglets is assigned to level 2 or 3, max. twice per year	Pen-faecal samples	Clarify distribution and type of infection in the herd, and clarify possible transmission from sow herds to slaughter-pig herds.

Slaughter-pig herds

Time	Sample taken	Purpose
At slaughter	Meat juice, 60-100 samples per herd per year. Herds in RBOV[a]: one meat juice sample per month	Calculation of slaughter-pig index. Assigning herds to level 1-3 and assigning herds to risk-based surveillance (RBOV)[a]
Herds assigned to level 2 or 3, max. twice per year	Pen-faecal samples	Clarify distribution and type of infection in the herd

Pork carcasses at the slaughterhouse

No. of samples	Sample taken	Time and no. of animals slaughtered
5 samples daily pooled into one analysis	Swab samples from 3 designated areas	> 200 pigs slaughter/day
5 samples pr 200 slaughtered pig, pooled into one analysis	Swab samples from 3 designated areas	> 200 pigs pr. months, < = 200 pigs pr. day
5 samples every 3rd month, pooled into one analysis	Swab samples from 3 designated areas	> 50 pigs pr. month, < 200 pigs pr. month
1 sample every 3rd month	Swab samples from 3 designated areas	< 50 pigs pr. month

[a] RBOV: risk-based surveillance where the sample size in herds with a SP-index of zero (no positive samples in the previous 3 months) are reduced to one sample per month.

Source: DVFA

Table A24. **Salmonella *Dublin surveillance of the cattle production, 2006.***

Milk producing herds		
No. of tests	Sample taken	Herd level
4 samples distributed over 13 months	Tank milk	1a
8 samples	Blood samples	1b
Non-milk producing herds		
No. of tests	Sample taken	Herd level
1 sample - except if the herd has been tested for S. Dublin within the last 120 day or 8 samples have been tested within the last 12 months. Then no samples are taken.	Blood samples	1b
If the owner wants a herd moved from level 2 to 1b: Number of samples: Total number of animals in the herd minus 2 (max. 8 animals, min. 4 animals)	Blood samples	2 ->1b
Beef carcasses at the slaughterhouse		
No. of samples	Sample taken	Time and no. of animals slaughtered
5 samples daily pooled into one analysis	Swab samples from 3 designated areas	> 200 cattles slaughter/day
5 samples pr 200 slaughtered cattle, pooled into one analysis	Swab samples from 3 designated areas	> 200 cattles pr. months, < = 200 cattles pr. day
5 samples every 3. month, pooled into one analysis	Swab samples from 3 designated areas	> 50 cattles pr. month, < 200 cattles pr. month
1 sample every 3. month	Swab samples from 3 designated areas	< 50 cattles pr. month

Source: DVFA

Antimicrobial Resistance

For information on antimicrobial resistance in zoonotic bacteria please refer to the annual report "DANMAP – Consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, food and humans in Denmark". The 2006 DANMAP report will be available in September 2007 from www.danmap.org or may be ordered from the Danish Zoonosis Centre (dzc@dzc.dk)

Appendix

Demographic data

Human population, 2006.

Age group (years)	males	females	Total
0-4	166,381	158,502	324,883
5-14	353,258	336,012	689,270
15-24	316,319	302,757	619,076
25-44	765,005	750,401	1,515,406
45-64	743,436	729,268	1,472,704
> 65	352,263	473,482	825,745
TOTAL	2,696,662	2,750,422	5,447,084

Source: The statistical Yearbook 2006, Danmarks Statistik

Number of herds, livestock and animals slaughtered, 2006.

	Herds/flocks[1]	Livestock[1]	Number slaughtered
Pigs	13,869	14,581,382	21,106,788
Cattle	27,832	1,620,826	489,470
Broilers	338	20,218,452	106,679,930
Laying hens excl. barnyard	284	3,099,504	994,919
Turkeys	54	530,975	778
Sheep & lambs	10,818	195,907	83,954
Goats	3,334	21,011	2,091
Horses	-	-	2,539

[1] October 2006

Source: The Central Husbandry Register and DVFA

Number of farms in the table-egg production, 2006.

	No. of farms	No. of houses	Livestock (capacity)
Rearing breeding	6	7	20,000
Adult breeders	6	9	30,000
Hatcheries	5		
Pullet-rearing	100	165	1,500,000
Layers excl. Barnyard	245	342	3,110,000

Source: DVFA and DMA

Number of farms in the broiler production, 2006.

	No. of farms	No. of houses	Livestock (capacity)
Rearing breeding	17	49	140,000
Adult breeders	46	52	720,000
Hatcheries	5		
Broilers	267	657	n.a.

Source: DVFA and DMA

Danish Zoonosis Centre
National Food Institute
Technical University of Denmark
Mørkhøj Bygade 19
DK - 2860 Søborg
Denmark

P: +45 72 34 70 84
F: +45 72 34 70 28
www.food.dtu.dk

ISSN : 0909-4172

Contributing Institutions:

Danish Zoonosis Centre (DZC)
Mørkhøj Bygade 19
DK - 2860 Søborg
Tel: +45 7234 7084
Fax: +45 7234 7028
E-mail: dzc@dzc.dk
www.food.dtu.dk

The National Food Institute
Mørkhøj Bygade 19
DK - 2860 Søborg
Tel: +45 7234 7000
Fax: +45 7234 7001
E-mail: food@food.dtu.dk
www.food.dtu.dk

Statens Serum Institut (SSI)
Artillerivej 5
2300 København S
Tel: +45 3268 3268
Fax: +45 3268 3868
E-mail: serum@ssi.dk
www.ssi.dk

The Danish Veterinary and Food Administration (DFVA)
The Regional Veterinary and Food Control Authorities (RVFCA)
Mørkhøj Bygade 19
2860 Søborg
Tel: +45 3395 6000
Fax: +45 3395 6001
E-mail: fvst@fvst.dk
www.fvst.dk

The National Veterinary Institute (Vet-DTU)
Bülowsvej 27
DK - 1790 Frederiksberg
Tel: +45 7234 6000
Fax: +45 7234 6001
E-mail: vet@vet.dtu.dk
www.vet.dtu.dk

The Danish Plant Directorate (PD)
Skovbrynet 20
2800 Lyngby
Tel: +45 4526 3600
Fax: +45 4526 3610
E-mail: pdir@pdir.dk
www.plantedir.dk

Danish Meat Association (DMA)
Axelborg
Axeltorv 3
1609 København V
Tel: +45 33732500
Fax +45 33732510
E-mail: dma@danishmeat.dk
www.danishmeatassociation..dk