Annual Report on Zoonoses in Denmark 2009

DTU Food
National Food Institute

Annual Report on Zoonoses in Denmark 2009

Edited by:
Birgitte Helwigh and Anne Louise Krogh
Danish Zoonosis Centre
National Food Institute
Technical University of Denmark

Steen Ethelberg
Statens Serum Institut

This is an official publication from the National Food Institute, Technical University of Denmark, the Danish Veterinary and Food Administration and Statens Serum Institut.

Suggested citation:
Anonymous, 2010. Annual Report on Zoonoses in Denmark 2009, National Food Institute, Technical University of Denmark.

Reprints can be ordered from:
Danish Zoonosis Centre
National Food Institute
Technical University of Denmark
Mørkhøj Bygade 19
DK - 2860 Søborg
Denmark
Phone: +45 40 21 53 77
Fax: +45 35 88 70 28
E-mail: vibb@food.dtu.dk

Layout: Susanne Carlsson
Photos: Colourbox and Mikkel Adsbøl
Printing: Rosendahls Schultz Grafisk A/S

2. edition with minor corrections

ISSN 0909-3837

The report is also available at:
www.food.dtu.dk

Contents

Introduction

Humans

Denmark has for several years had one of the highest human incidences of listeriosis in EU and 2009 will probably be no different since the number of human cases increased with 90%; 51 cases in 2008 and 97 cases in 2009. A part of the increase was caused by a small outbreak encompassing eight cases. A working group with experts from the National Food Institute, Statens Serum Institut and the National Food and Veterinary Administration collected all available data and found no conclusive explanations for the increase. The fact that the Danish consumption surveys have shown that elderly people have increased their consumption of products with a higher risk of *Listeria* (e.g. soft cheeses, delimeats) during the last 5-10 years, may explain some of the observed increase during the later years. This can, however, not explain the large increase in 2009.

The *Salmonella* source account estimated table eggs and Danish produced pork as the most important sources of salmonellosis in 2009, although the estimated number of cases due to pork decreased by 50% compared with 2008, where several pork-related outbreaks resulted in an increase compared with previous years. Two large general outbreaks related to Danish produced table eggs were reported in 2009. One of them encompassed both a general increase in human cases as well as a confined outbreak at a large swimming competition. The estimated number of human cases due to table eggs increased two fold due to these outbreaks. The estimated number of sporadic cases due to table eggs decreased compared with 2008. Imported meat was estimated to have caused five times as many cases as in 2008. Only few human cases were estimated to have Danish and imported broiler meat as a source in 2009.

The number of reported outbreaks decreased from 66 in 2008 to 50 in 2009, however there were several large outbreaks with more than 100 cases resulting in the total number of outbreak related cases to increase in 2009; e.g. outbreaks related to egg, water or buffet meals. The large *S.* Typhimurium U292 outbreak and the *S.* Typhimurium DT 135 and DT 3 outbreaks described in the Annual Report 2008 continued in 2009 with lowered incidence; unfortunately the sources remained unknown.

The distributions of human cases with *Salmonella* (divided into Typhimurium, Enteritidis and 'other serotypes'), *Campylobacter*, VTEC and *Yersinia* split into groups by sex and age are presented for the first time in appendix B. For all pathogens, very little difference between the number of male and female cases were observed, except for *Campylobacter* where 20% more male cases were reported in 2009. For human salmonellellosis, with the exception of infections caused by *S.* Enteritidis, the reported incidence was highest among children less than five years. For *S.* Typhimurium infections, this age distribution was mainly due to three large outbreaks that started in 2008 and continued in 2009, as all three outbreaks had an overweight of children less than five years. VTEC and *Yersinia* infections had a higher incidence among the very small children as well. The age distribution of *S.* Enteritidis and *Campylobacter* cases was more evenly spread out.

Broiler production

In the broiler production, the number of *Salmonella* positive flocks has been decreasing for many years and 0.9% of the flocks slaughtered in Denmark were positive in 2009. The surveillance programme was tightened in 2008 with one additional sampling at the farm before slaughter and a stricter biosecurity scheme at the farm. The 1% EU target set out in the Regulation (EC) 646/2007 for *S.* Typhimurium and *S.* Enteritidis in broiler flocks must be reached

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 2009. Greenland and the Faeroe Islands are not represented. The report is based on data collected according to the Zoonoses Directive 2003/99/EC, supplemented by data obtained from national surveillance and control programmes as well as data from relevant research projects. Occasionally corrections to the data may occur after publication resulting in minor changes in the presentation of the report is also available at www.food.dtu.dk.

by all Member States by December 31st 2012. In 2009, the prevalence of *S.* Typhimurium in Danish broiler flocks was 0.3%, and there was no positive findings of *S.* Enteritidis in the flocks. In the EU baseline study on *Salmonella* on broiler carcasses carried out in all Member States in 2008, no positive batches were found in Denmark. At the EU level, the prevalence was 16%.

Campylobacter in Danish broiler meat from conventional and organic production systems has been investigated as part of the Danish action plan against *Campylobacter*. Results showed that organic broiler meat was more often contaminated with *Campylobacter* than conventional broiler meat.

Pig production

The level of *Salmonella* positive breeder and multiplier pig herds decreased in 2009 compared with the previous years; from 2001 to 2008 the prevalence has been increasing.

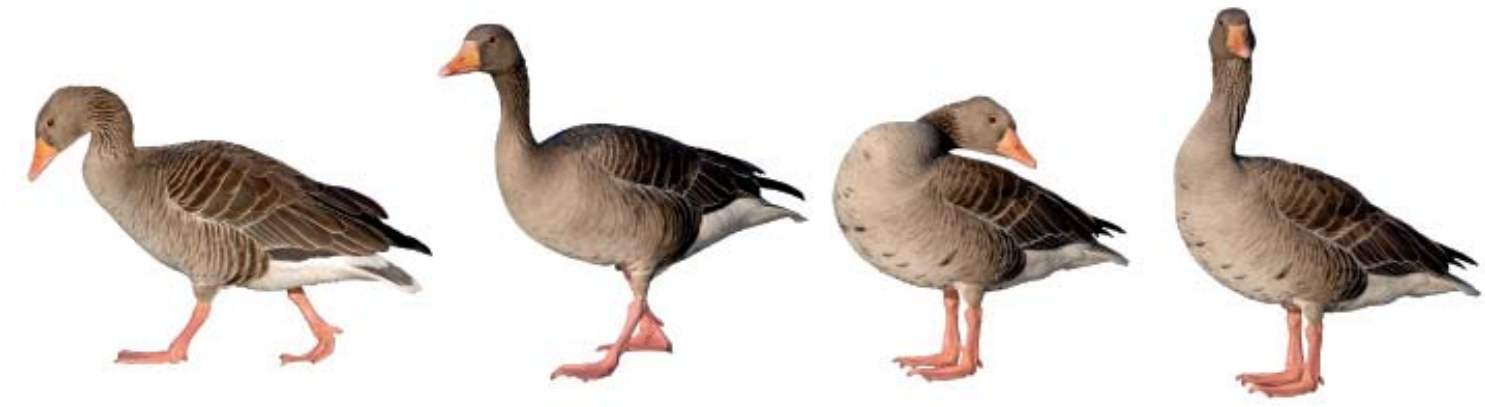
In 2002, the ban of trade of animals from herds with a high serological reaction against *Salmonella* (the *Salmonella* index) was replaced by a duty to provide information about the *Salmonella* status in the herd. In April 2008, a new contingency plan started where the industry introduced a penalty for live trade from breeder and multiplier herds with a high *Salmonella* index (index>10). At the end of 2009, the prevalence had decreased to the same level as in 2002. Some of the decrease is probably due to these new actions, as a decrease in the seroprevalence in breeder and multiplier pig herds was observed immediately after the introduction of the penalty. Additionally, the proportion of positive slaughter pig herds decreased during the same period indicating that tightening of the surveillance programme at the breeding level has an effect throughout the breeding pyramid.

Possible differences in the *Salmonella* infection level between conventional and alternative production systems for slaugter pigs has been investigated. The results showed a higher *Salmonella* prevalence in conventional production compared with organic and non-organic free range production. However, for all three production systems several *Salmonella* reducing measures could be implemented to a further extend; e.g. purchase of pigs from *Salmonella* free herds, use of barley and more structured feed.

The EU baseline survey carried out in 2008 on *Salmonella* in breeder, multiplier and sow herds showed that 41% of the Danish breeder and multiplier herds as well as sow herds were positive, which was above EU average (29% for breeder and multiplier herds and 33% for sow herds). Of the six EU baseline surveys conducted on *Salmonella*, this was the only one, where Denmark was found to have a higher prevalence than the EU average.

Miscellaneous

In November 2009, a 14 year old slaughter cow was tested positive with classical BSE. This was the first case found since 2005. The cow was probably infected by a BSE positive feed batch distributed in Denmark in the mid-nineties, which gave rise to a peak of incidence in the 1996-cohort. New cases of BSE in cattle might appear as long as animals from this cohort are still alive, although at a very low risk. There have been no cases in Danish cattle born after the EU-wide feed-ban was introduced in January 2001. Denmark continues to test all slaughter and risk animals (fallen stock, emergency slaughters, etc.) over 48 months according the EU regulation.



1. Trends and sources in human salmonellosis

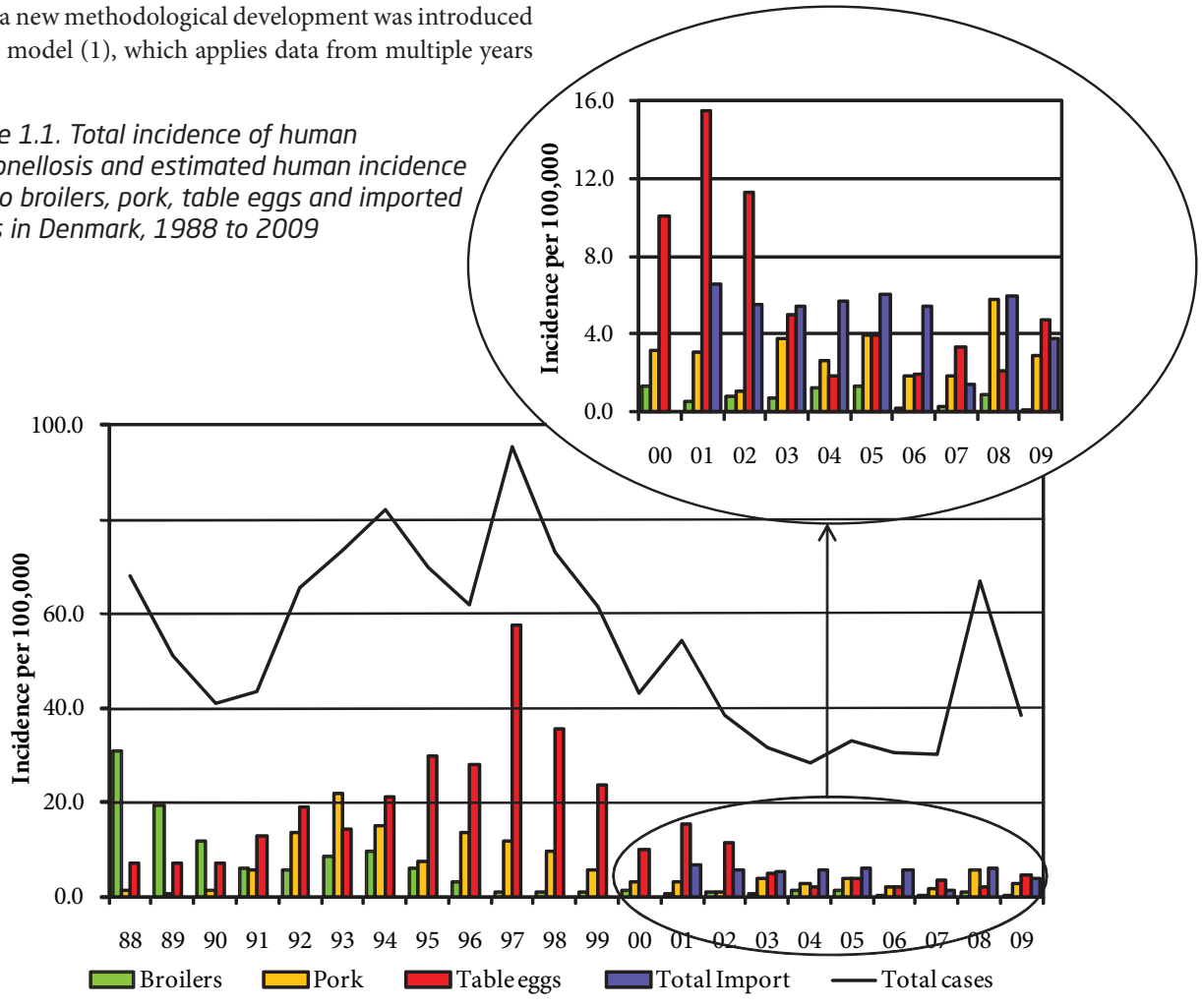
By Sara Monteiro Pires (smpi@food.dtu.dk) and Tine Hald

1.1 *Salmonella* source account 2009

The Danish Zoonosis Centre routinely applies a source attribution model to estimate the contribution of the major animal-food sources to human infections of *Salmonella*. The principle of the method is to compare the number of human cases caused by different *Salmonella* sero- and phage types with the distribution of the same subtypes isolated from the various animal-food sources. Antimicrobial resistance profiles of *S.* Typhimurium isolates are also included to further distinguish between similar phage types found in animals, food and humans. Since the model was first implemented in 1995, it has evolved from being purely deterministic to becoming a stochastic model, built under a Bayesian framework. In 2008, a new methodological development was introduced in the model (1), which applies data from multiple years thereby improving the robustness and accurateness of the results. Results have been instrumental to evaluate trends on the most important sources of human salmonellosis and prioritize interventions in Denmark. The proportion of cases that were attributable to the major food sources in the last two decades is presented in Figure 1.1.

The incidence of human salmonellosis was 38.5 cases per 100,000 inhabitants in 2009 (10.8 for *S.* Enteritidis and 13.9 for *S.* Typhimurium) (appendix B, Table A2). This represents a substantial decrease when compared with 2008, particularly in the incidence of infections by *S.* Typhimurium, a reflection of a large and long-lasting outbreak that occurred in Denmark in 2008 (see chapter 2 for more information), although the outbreak continued at a lower level in 2009. However, due to this continued outbreak the human incidence reported in 2009 was still higher than what was observed in the six years prior to 2008.

Figure 1.1. Total incidence of human salmonellosis and estimated human incidence due to broilers, pork, table eggs and imported foods in Denmark, 1988 to 2009



Source: Danish Zoonosis Centre, National Food Institute

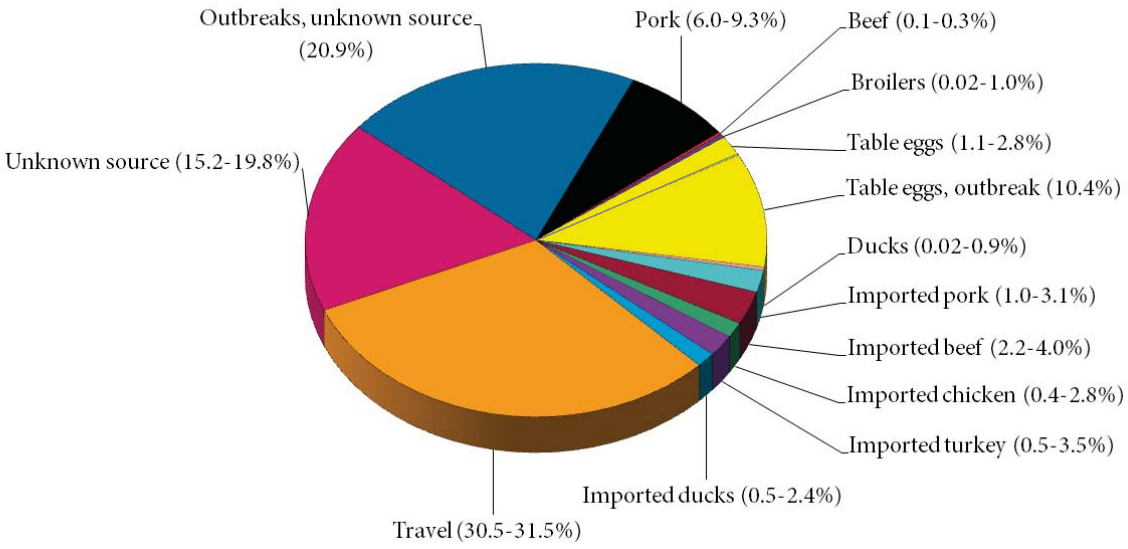
In 2009, the main sources to human *Salmonella* infections were table eggs (12.3%), pork (7.6%), imported beef (3.1%), imported pork (2.0%) and imported turkey (2.0%) (appendix A, Table A1). The remaining sources contributed to a minor proportion of human cases, and 17.6% of human cases could not be attributed to any source. The total estimated number of travel related cases was 658 (30.9%) in 2009, which represents a decrease in the number of cases compared with 2008 and 2007. One possible explanation for this decrease might be that Danes travelled less in 2009 compared with previous years (2). As in 2008, a relatively large proportion of the cases (445 cases) was related to outbreaks with unknown source in 2009, although it decreased more than three-fold compared with 2008 (1,447 cases). The number of cases related to outbreaks with unknown source was still very high in 2009 (appendix A, Table A1). The outbreak related cases were primarily due to sources of domestic origin.

The relatively high importance of table eggs to human salmonellosis this year is explained by the occurrence of two outbreaks, where eggs were identified as the causative source (Figure 1.2 and chapter 2). Among sporadic cases, only 1.9% cases were attributed to table eggs, which suggests that this source is of relatively low importance for sporadic salmonellosis when compared with other food sources. Pork was estimated to be an important source of *Salmonella* in 2009 (7.6%), but the number of cases attributed to this source decreased two-fold when compared with 2008 (appendix A, Table A1). The high number of pork related cases in 2008 was partly due to four outbreaks where pork was the source. There were no reported pork-related outbreaks in 2009. Around 10% of all *Salmonella* infections were attributed to imported products with imported beef (3.1%) being the most important imported source in 2009. The estimated number of cases attributed to this source increased by a factor five when compared with 2008, whereas the contribution of other imported sources was either unchanged or decreased. Surveillance data of imported duck meat was included in the 2009 source account model, but this source had not been accounted for in the past two years, and thus estimates are not compared. The number of cases attributed to an unknown source decreased when compared with the previous year. These cases may be caused by foods not included in the national surveillance (e.g. imported or domestically produced fruits and vegetables), or by non-food sources of infection such as contact with pet animals.

Of the 600 *S.* Enteritidis cases, 43.8% were estimated to be related to international travel and 38.1% of the cases were associated with outbreaks. The number of *S.* Enteritidis infections acquired abroad markedly decreased when compared with 2008 (see box) and the number of outbreak-related cases increased 30 times due to the two large egg-related outbreaks (appendix B, Table A3). Among the 767 *S.* Typhimurium cases, 55.8% were part of outbreaks and 12.0% were estimated to be acquired abroad.

Of the *S.* Typhimurium cases attributable to domestic products, the majority (53.6%) was caused by types susceptible to all tested antimicrobials, 36.3% by types resistant to one to three antimicrobial drugs, 6.3% by types resistant to quinolones, and 3.7% by types resistant to four or more antimicrobial drugs (multi-resistant) (Figure 1.3). 2009 was the third year in a row where the number of cases with multi-resistant types has decreased. In contrast, there were several domestic cases with quinolone-resistant types in 2009. The majority of *S.* Typhimurium infections

Figure 1.2. Estimated sources of 2,129 cases of human salmonellosis in Denmark, 2009 (See also Appendix A, Table A1)



Source: Danish Zoonosis Centre, National Food Institute

attributed to imported food products was caused by resistant (48.2%) or multi-resistant (29.0%) types, no cases was caused by quinolone-resistant types from imported products. Of travel related *S.* Typhimurium cases, 50.1% were caused by types susceptible to all tested antimicrobials, 29.0% were caused by resistant types, 16.7% by multi-resistant types, and 4.2% by types resistant to quinolones. This is different from 2008, where 73.2% of the travel related cases were either resistant, multi-resistant or quinolones-resistant and only 26.8% were fully susceptible.

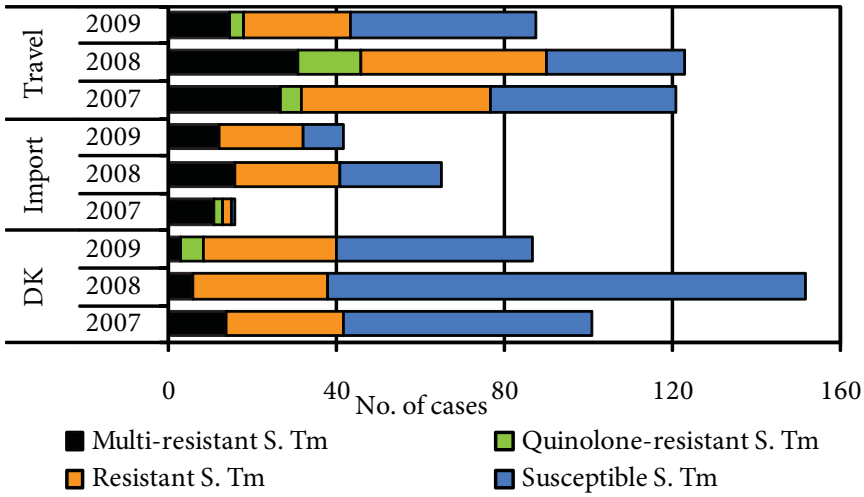
In 2009, the total number of reported *Salmonella* cases was 2,129, corresponding to a decrease of nearly 60% compared with 2008, where the number of cases reached a level not observed since the late 90's, which was mainly due to the very large *S.* Typhimurium U292 outbreak. This outbreak and several other outbreaks continued throughout 2009, although at a lower level (see chapter 2), but still resulting in a 16.6-27.8% increase in the total number of cases compared with the year 2003-2007.

References

(1) Pires SM, Hald T (2009). Assessing the differences in public-health impact of Salmonella subtypes using a Bayesian microbial subtyping approach for source attribution. Foodborne Pathogens and Diseases, 7(2).

(2) Pers. comm., Managing Director Lars Thykier, The Association of Danish Travel Agents and Tour Operators.

Figure 1.3. Estimated sources of antimicrobial resistant[a] S. Typhimurium infections in humans, 2007-2009



a) Resistant: Resistant to one to three antimicrobial drugs; Multi-resistant: Resistant to four or more antimicrobial drugs.
Source: Danish Zoonosis Centre, National Food Institute

Where do we acquire *Salmonella* infections?

In 2009, as in 2008, Statens Serum Institut attempted to interview all registered *Salmonella* cases where no travel information was reported by the general practitioner. The patients were asked about the date of disease onset and whether they had travelled abroad within a seven-day period prior to disease onset. In 2009, information was obtained from a total of 75% of the *Salmonella* cases. Among the cases with known travel history, 46% of the *S.* Enteritidis cases, 11% of the *S.* Typhimurium cases and 40% of cases with other serotypes were infected abroad. The group of other serotypes comprises considerable variation in terms of serotypes.

In 2009, the distribution pattern of travel related and domestically acquired *Salmonella* infections was comparable to that of 2008 for most serotypes. However, for *S.* Enteritidis the percentage of cases acquired abroad decreased from 61% in 2008 to 45% in 2009 (Table 1.1).

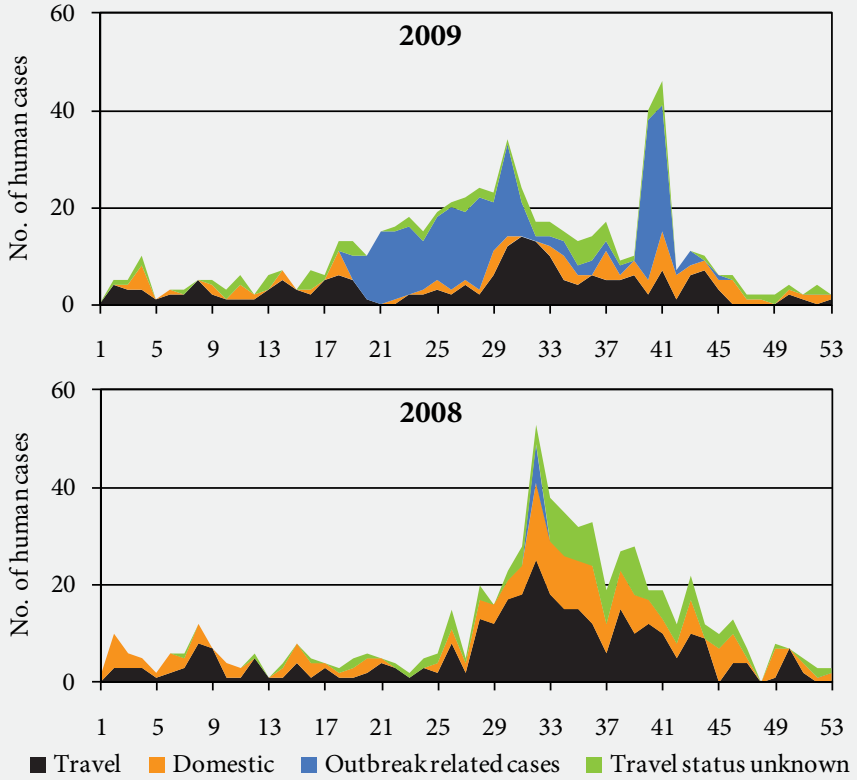
During the summer months, a peak in the number of *S.* Enteritidis cases is normally observed in Denmark. Other European countries also report a summer peak (2). However, in 2009 a summer peak was not seen and the large number of cases in early summer and a peak in the autumn was mainly due to two outbreaks related to eggs (Figure 1.4 and chapter 2). Fewer *S.* Enteritidis cases were acquired abroad during the summer months in 2009 compared with 2008 (Figure 1.4). In 2009, Danes travelled to a lesser extend to destinations outside of Europe compared with previous years according to the travel industry (1). Within the EU, harmonized *Salmonella* surveillance programmes for the poultry production has been introduced and a decrease in the level of *Salmonella* in the breeding and laying hen flocks was observed already in 2008. Hence, it must be expected that the general exposure to *Salmonella* is decreasing in the EU (2).

Table 1.1 Top 10 Salmonella *serotypes in humans and place of infection, 2008-2009*

2008	Number of patients (%)	% patients infected[a] Abroad	Domestically	2009	Number of patients (%)	% patients infected[a] Abroad	Domestically
S. Typhimurium	2,002 (55)	6.3	93.7	*S.* Typhimurium	767 (36)	10.6	89.4
S. Enteritidis	638 (17)	60.6	39.4	*S.* Enteritidis	600 (28)	45.7	54.3
S . Agona	71 (2)	12.7	87.3	*S.* O:4,5,12;H:i:-	77 (4)	41.9	58.1
S. Newport	59 (2)	26.2	73.8	*S.* Dublin	46 (2)	6.9	93.1
S. O:4,5,12;H:i:-	57 (2)	29.3	70.7	*S.* Newport	42 (2)	45.5	54.5
S. Stanley	44 (1)	84.4	15.6	*S.* Virchow	36 (2)	79.3	20.7
S. Java	40 (1)	17.2	82.8	*S.* Agona	27 (1)	13.3	86.7
S. Infantis	38 (1)	53.8	46.2	*S.* infantis	25 (1)	38.1	61.9
S. Saintpaul	36 (1)	18.5	81.5	*S.* Saintpaul	23 (1)	23.5	76.5
S. Virchow	33 (1)	82.1	17.9	*S.* Muenchen	20 (1)	8.3	91.7
Other serotypes	638 (18)	32.5	67.5	Other serotypes	466 (22)	42.3	57.7
Total	3,656 (100)	21.9	78.1	Total	2,129 (100)	31.1	68.9

a) Patients with unknown travel information (26.4% of all patients in 2009 and 13.9% of all patients in 2008) were excluded from the percent calculations.
Source: Statens Serum Institut

Figure 1.4. Weekly distribution of S. Enteritidis *cases, 2008-2009*



Source: Statens Serum Institut

References

(1) Pers. comm., Managing Director Lars Thykier, The Association of Danish Travel Agents and Tour Operators .
(2) The Community Summary Report on Trends and Sources of Zoonoses, Zoonotic Agents and foodborne outbreaks in the European Union in 2008, EFSA Journal; 2010 8(1):1496.

2. Outbreaks of special interest

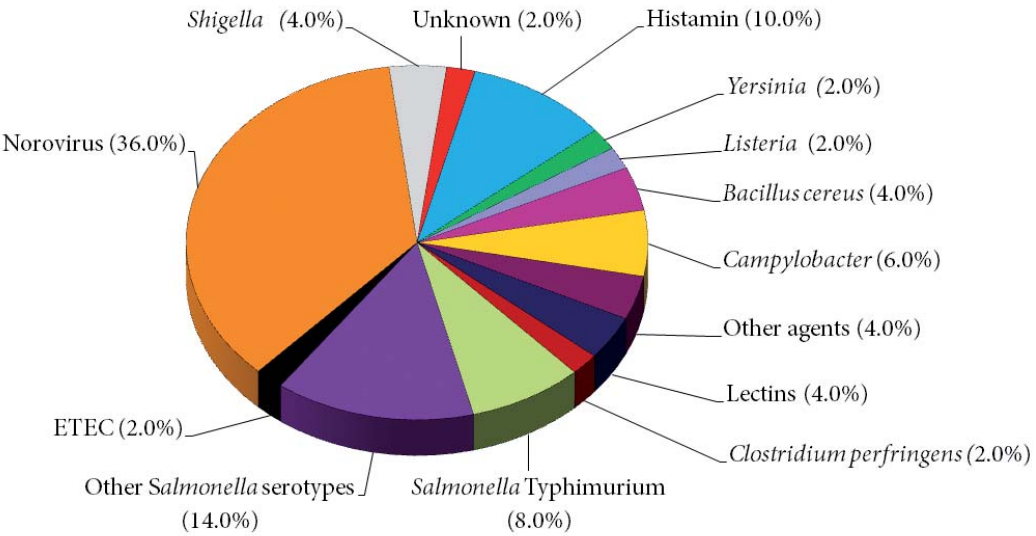
By Steen Ethelberg (set@ssi.dk)

In Denmark, foodborne outbreaks are investigated by a number of different institutions, depending on the nature of the outbreak. Small local foodborne outbreaks are primarily handled by the Regional Veterinary and Food Control Authority. For larger local outbreaks, ad hoc outbreak groups are formed in collaboration with the medical officer and the relevant local laboratory. Large, cross-regional foodborne outbreaks are typically investigated by Statens Serum Institut, the National Food Institute, Technical University of Denmark and the Danish Veterinary and Food Administration. These institutions have for several years been conducting weekly outbreak-response coordination meetings.

Outbreaks are reported in the Food- and waterborne Outbreak Database (FUD). Outbreaks that occurred in 2009 are presented in appendix B, Table A3. Household outbreaks and clusters that could not be verified as common source outbreaks are not included in the table. Figure 2.1 shows the relative distribution of these outbreaks by the different pathogens that caused them. The reporting and outbreak investigation systems are described in further detail in chapter 7.2. Some of the more notable outbreaks are outlined below.

Outbreaks with *S.* Enteritidis have become rare in recent years as a result of the successful *Salmonella* control programs targeting the Danish egg layer and broiler production. Nevertheless, in 2009 two outbreaks caused by eggs occurred. One outbreak comprising 150 laboratory confirmed cases with *S.* Enteritidis phage type 8 occured in the early summer (FUD no. 891, appendix B, Table A3). Interviews with cases revealed that several of the cases had become ill after eating in small groups at different restaurants, and trace-back of the suppliers of eggs to these restaurants pointed to one specific egg producer. Upon investigation, *S.* Enteritidis phage type 8 with a matching MLVA type was recovered from the egg producer. Following withdrawal of the eggs, the outbreak stopped (1). The second outbreak was caused by eggs contaminated with *S.* Enteritidis phage type 13a, originating from a single producer. The eggs gave rise to a general outbreak, which was detected as an increase in human cases in the period (FUD no. 917) and to an outbreak confined to participants in a large swimming competition during a weekend in September (FUD no. 928). In the latter outbreak, 86 cases were identified from a cohort study and 42 cases were laboratory confirmed. A trace-back investigation of eggs used by caterers at the swimming competition helped to locate the producer. Positive *Salmonella* test results from

Figure 2.1. Aetiology of foodborne disease outbreaks reported with a causative agent in the Food- and waterborne Outbreak Database (FUD), 2009. Percentage of total outbreaks indicated in brackets



Source: Statens Serum Institut

the premises resulted in a recall of all eggs that were potentially delivered by this producer.

An outbreak with *Listeria monocytogenes* occurred in the beginning of the year (FUD no. 887). The outbreak was detected by use of PFGE typing of patient isolates referred to Statens Serum Institut. It comprised eight cases; all were elderly, two died. All cases received food from a meals-on-wheels service catering for senior citizens and the source was found to be a specific dish containing beef, which was meant to receive final heat treatment by microwave oven in the homes of the costumers (2).

A large waterborne outbreak took place in June in a town with approx 5,000 inhabitants south of Copenhagen (FUD no. 900). A total of 39 cases of *Campylobacter jejuni* were laboratory confirmed and there was an estimated 500 cases in total based on results from a questionnaire study performed by Statens Serum Institut in which a little more than 1,000 inhabitants participated. The study showed a dose-response relationship between intake of tap water and the risk of becoming ill. The likely cause of the contamination was identified as a malfunctioning water pipe installation which became contaminated following heavy rainfalls.

Two large and one smaller outbreak of *S.* Typhimurium which began in 2008 continued into 2009. The unusually large outbreak with *S.* Typhimurium phage type U292 (FUD no. 788, see Annual Report on Zoonoses 2008 for more imformation) gave rise to 228 laboratory confirmed cases in 2009 and an outbreak with another rare phage type, *S.* Typhimurium DT 135 (FUD no. 854), accounted for 90 laboratory confirmed cases. The *S.* Typhimurium DT 3 outbreak resulted in 30 cases in 2009 (FUD no. 883). These outbreaks, in particular the U292 outbreak, was the subject of intense investigations in both 2008 and 2009 (3), however, the sources of the outbreaks were not found and only a very small number of new cases were seen towards the end of 2009. The U292 outbreak gave rise to 1,452 cases over both 2008 and 2009 and appeared to be largely confined to Denmark. The epidemiology of the

outbreak was complex and towards the end of the outbreak period, the main hypothesis remained that the outbreak was caused by a series of different foods and originated from a pig reservoir.

Finally, it should also be mentioned that foodborne outbreaks also occurred as a result of infections with non-zoonotic agents. As in previous years, norovirus was the single most frequent disease agent in the registered out-breaks (appendix B, Table A3). Of the 52 reported foodborne outbreaks in 2009, norovirus accounted for 18 with a total of 626 registered cases. These outbreaks were generally a result of contamination events associated with workplace lunch buffets, restaurants and private parties. Several of these outbreaks followed gastrointestinal symptoms in persons preparing the food. Another non-zoonotic disease outbreak was caused by *Shigella sonnei*. A total of ten laboratory confirmed cases were caused by consumption of contaminated sugar peas imported from Africa and cases also occurred in other European countries (4).

References

(1) Statens Serum Institut (2009): EPI-NEWS, week 36.

(2) Smith B, Larsson JT, Lisby M, Müller L, Madsen SB, Engberg J, Bangsborg J, Ethelberg S, Kemp M. 2010. Outbreak of *Listeria monocytogenes* caused by Beef meat from a Meals-on-Wheel's delivery, Denmark 2009. Clin. Microbiol. Infect. In press, doi: 10.1111/j.1469-0691.2010.03200.x

(3) Ethelberg S, Wingstrand A, Jensen T, Sørensen G, Müller L, Nielsen EM, Mølbak K (2008). Large ongoing outbreak of infection with *Salmonella* Typhimurium U292 in Denmark, February-July 2008. Euro Surveill 13(28).

(4) Muller L, Jensen T, Petersen RF, Molbak K, Ethelberg *S.* Imported fresh sugar peas as suspected source of an outbreak of *Shigella sonnei* in Denmark, April-May 2009. Euro Surveill 2009;14(24).

3. *Listeria* in Denmark

By Annette Perge (ape@fvst.dk), Steen Ethelberg, Eva Møller Nielsen and Hanne Rosenquist

Listeriosis is a serious, food borne infection caused by *Listeria monocytogenes*. It is a ubiquitous bacterium that can be transmitted via food. Exposure may lead to invasive listeriosis in predisposed individuals. Classical risk factors for invasive listeriosis include pregnancy, old age, malignancies, diabetes, alcoholism and diseases or treatments leading to an impaired immune response. The disease primarily manifests as sepsis, meningitis or materno-fetal infections. The population at risk is in particular elderly, immune-suppressed individuals and the case-fatality rate is 20-30%.

In 2009, the number of listeriosis cases almost doubled in Denmark compared with 2008, from 57 cases in 2008 to 97 cases in 2009 (1). However, even before this increase, Denmark had one of the highest listeriosis incidences in Europe (2,3). To seek explanations for the increase in 2009, a working group was formed to study the Danish surveillance and monitoring data. A summary of this work is presented below. Scientists from Statens Serum Institut, the Danish Veterinary and Food Administration, and the National Food Institute, Technical University of Denmark were part of the working group.

3.1 Human cases

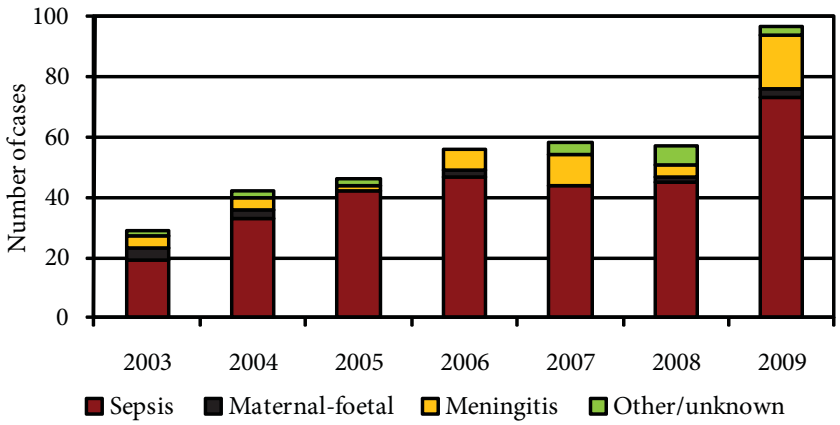
In Denmark, culture-confirmed cases of listeriosis are notifiable by clinical laboratories to Statens Serum Institut. The isolates are send to Statens Serum Institut for PFGE typing as part of the outbreak surveillance.

In 2009, the number of cases increased by 90% compared with the previous year (Figure 3.1). There were 97 notified cases of invasive listeriosis, which corresponds to an overall incidence of 1.8 per 100,000 inhabitants. This is much higher than the incidences of 0-1.3 per 100,000 inhabitants from other EU Member States in previous years (2,3,4). PFGE-typing revealed 51 different PFGE-types among the 97 isolates. The most common type, with 16 isolates scattered over the year, was also commonly reported in previous years, representing 21% of the isolates in 2006-9. In the spring of 2009, a verified outbreak included eight cases with a PFGE-type not previously reported in Denmark (see chapter 2). In the autumn of 2009, a cluster of seven cases was identified, but it was not possible to establish this cluster as an outbreak. The PFGE-type of this cluster is a fairly common type represented by 2 to 5 cases per year in previous years. Disregarding these 15 possible outbreak-related cases, the incidence was still comparatively high, at 1.5 per 100,000 inhabitants.

Of the 97 cases, 55% was female, 85% was 60 years or older and 32% was 80 years or older. There were three materno-fetal cases (3%), 18 cases (19%) presented with meningitis, 73 cases (75%) presented with sepsis and three cases (3%) had other kinds of infections. The relative distribution of the manifestations is not markedly different from previous years (Figure 3.1). The fact that the increase in cases is seen both for sepsis and meningitis cases may indicate that the rise is not solely due to an increased rate of analyses or notifications.

As can be seen from Figure 3.1, there has been a generally increasing trend in listeriosis since 2003.

Figure 3.1. Number of notified cases of invasive listeriosis 2003-2009, divided into the major manifestations



Source: Statens Serum Institut

Table 3.1. Presence of Listeria monocytogenes *in foodstuffs (Centrally coordinated projects 2003-2010)*

Year	Product category	Analysis	Number of samples	Number of positive samples	Quantitative level (*L. monocytogenes* (L.m.) per g)
2003	Meat products, heat treated, long shelf life, - at start and at end of shelflife	Qualitative and quantitative	997	14	All positive samples had less than 50 L.m. per g
2004	Smoked/gravad fish, - at start and at end of shelflife	Qualitative Quantitative	1,344 1,311	137 13	1 positive sample had more than 100 L.m. per g
2005	RTE green salads with fish/shellfish or meat[1]	Quantitative	130	1	1 positive sample had more than 100 L.m. per g
2005	Pasteurized cheese[a]	Qualitative	269 (50 batches)	0	
2005	Milk, cream, conventional and organic	Qualitative	624	0	
2009-2010	Smoked/gravad fish[b], - at start and at end of shelflife	Qualitative and quantitative	140 (14 batches)	23 (4 batches)	All positive samples had less than 10 L.m. per g
2009-2010	Prepared dishes[b]	Qualitative and quantitative	12 192	0 12	All samples had less than 10 L.m. per g
2009-2010	Fermented sausages[b]	Quantitative	389 (79 batches)	6 (3 batches)	All positive samples had less than 100 L.m. per g

a) EU coordinated projects.
b) Preliminary results. The projects are ongoing.
Source: National Food and Veterinary Administration and National Food Institute

3.2 Food and consumption

Since 2006, the EU Regulation on microbiological criteria[1] has been in force. The Regulation distinguishes between products supporting growth of *L. monocytogenes* and products not supporting growth. All ready-to-eat (RTE) products are covered and the maximum limit value at the end of shelflife is 100 colony forming units (cfu) *L. monocytogenes* per gram.

According to the EU Hygiene Regulation[2], food business operators shall implement and maintain procedures based on HACCP principles[3] in order to ensure the safety of their products. The microbiological criteria for *L. monocytogenes* should be used for validation and verification purposes, and the food business operators must decide the necessary sampling and testing frequencies as part of their HACCP based procedures. Food business operators producing products in which *L. monocytogenes* can grow should also carry out environmental testing for *L. monocytogenes* and perform shelflife studies.

The competent authority is obliged to control the food business operator's compliance with the criteria laid down in the legislation. Official sampling for *L. monocytogenes* is carried out either in the form of centrally coordinated laboratory projects or as part of the regional food inspectors' control of individual establishments (see chapter 7 for more details about the sampling). Centrally coordinated projects are planned for one year at a time and the investigated products change between years in order to sample all risk products over the years. Table 3.1 shows the results of these projects for the period 2003-2010. In total, more than 4,000 samples have been tested and only two samples were above 100 cfu *L. monocytogenes* per g.

1. Regulation (EC) No 2073/2005 of the Commission of 15 November 2005 on Microbiological criteria for foodstuffs with amendments
2. Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs with amendments
3. HACCP: Hazard analysis and critical control point

Table 3.2. Listeria monocytogenes *in RTE-products[a], 2005-2009*

	No. of samples	Positive samples	10-100 CFU[b]/g	> 100 CFU[b]/g
2005	1,018	13	3	3
2006	1,228	35	18	9
2007	1,577	13	7	2
2008	1,844	12	7	2
2009	244	5	0	0

a) Samples taken as part of the control of individual food producing establishments (qualitative and quantitative tests).
b) CFU: Colony forming units
Source: National Food and Veterinary Administration and National Food Institute

The Regional Veterinary and Food Administration may decide to sample and analyze for *L. monocytogenes* as part of the official control of individual food establishments, e.g. for products not covered by centrally coordinated projects or in case of suspicion of contamination, consumer complaints or foodborne diseases. The results of the official control of RTE products for the period 2005-2009 are summarized in Table 3.2. The investigated RTE products were primarily milk and milk products, meat products, fish products, vegetables including sprouts, prepared dishes and dressings. A smaller number of samples was analysed in 2009, partly because a relatively higher portion of the samples were collected as part of centrally coordinated projects. All samples with more than 100 cfu *L. monocytogenes* per gram were meat products. In 2006, 8 of 9 samples with more than 100 cfu *L. monocytogenes* per gram were unripened spreadable sausages.

Additional information about the occurrence of *L. monocytogenes* in Danish RTE products can also be collected from the EU rapid alert system for food and feed (RASFF). In total, four notifications, where the numbers of *L. monocytogenes* exceeded the limit for the microbiological criteria, were announced for smoked salmon produced in Denmark during 2008 and 2009.

The results of the official testing show that *L. monocytogenes* can be found in low levels in RTE products. Levels above 100 *L. monocytogenes* per gram are only found infrequently and only in meat products and in smoked fish. Within the last couple of years, there has been no increasing trend in the number of official samples exceeding the acceptable level of *L. monocytogenes.* Nor has there been an increase in withdrawal of foods by food business operators due to findings of unacceptable levels of *L. monocytogenes* in their products as part of their own control procedures.

The occurrence of high numbers of *L. monocytogenes* in RTE products may not have increased over the last 5 years, but if the consumption of this type of products has increased in the elderly population, this age group has become more exposed to *L. monocytogenes.* The dietary surveys conducted at the National Food Institute show that elderly above 65 years of age have had a steadily increased consumption of cold-smoked fish, semi-soft cheeses and cooked, smoked ham within the period 2000-2007. Hence, the elderly are increasingly exposed to RTE products and thereby *L. monocytogenes* and this may in theory explain part of the increasing trend in human listeriosis 2003-2007. However, the data from the dietary survey cannot explain the increase in human listeriosis from 2008 to 2009.

3.3 Conclusion

With reference to the available data, the substantial increase in human listeriosis from 2008 to 2009 cannot be explained. A number of possible explanations can be put forward; changes in the susceptibility in the elderly population, changes in the exposure to *L.monocytogenes* in food, but there is no evidence to explain why this increase has occurred.

References

(1) Jensen AK, Ethelberg S, Smith B, Nielsen EM, Larsson J, Mølbak K, Christensen JJ, Kemp M (2010) Substantial increase in listeriosis, Denmark 2009. Eurosurveillance 15 (12) article 4.

(2) European Centre for Disease Prevention and Control: Annual Epidemiological Report on Communical Diseases in Europe 2009.

(3) European Centre for Disease Prevention and Control: Annual Epidemiological Report on Communical Diseases in Europe 2008.

(4) The Community Summary Report on Trends and Sources of Zoonoses, Zoonotic Agents and food-borne outbreaks in the European Union in 2008, EFSA Journal; 2010 8(1):1496..

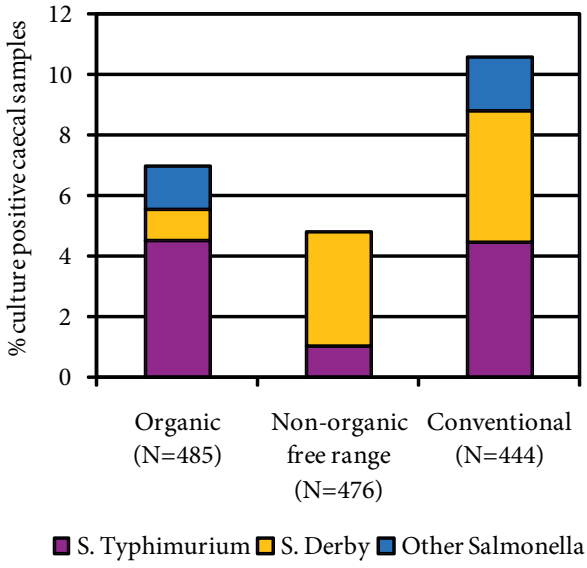
4. *Salmonella* in conventional and alternative slaughter pig production

By Anne Wingstrand (awin@food.dtu.dk), Anna I.V. Sørensen, Katrine Lundsby and Lars S. Larsen

The majority of all slaughter pigs in Denmark are produced in conventional indoor production systems, however a couple of alternative pig production concepts exist, among which the organic slaughter pig production and the production of non-organic free range pigs, both with access to outdoor pens, are the larger. The most important risk factors for *Salmonella* in the Danish conventional pig production are known to be:

- Purchase of infected pigs
- Feeding finely grinded pelleted feed
- Feeding dry feed (vs. wet fermented feed)
- Increasing herd size
- Continuous production (vs. strict batch production with cleaning, desiccation and disinfection of the pens).

Figure 4.1. Salmonella *culture results[a] in slaughter pigs from 52 organic herds, 27 free range herds and 147 conventional herds.*



a) A proportion of *S.* Typhimurium in organic herds and *S.* Derby in non-organic free range herds were from few high-shedding herds.
Source: National Food Institute

In the alternative pig productions, the increased contact with wildlife and the challenges associated with thorough cleaning and disinfection of outdoor pens or pastures, are expected to increase the exposure to *Salmonella*. However, very little research has been carried out within this field and only few comparisons between occurrence of zoonoses in the different Danish pig production systems have been done. Therefore, a project (QUALYSAFE) was carried out in 2007-2008 to examine the difference in *Salmonella* prevalence in conventional and non-conventional production systems and to identify common or specific risk factors for different production systems.

In total, 1,402 caecal samples collected from slaughter pigs from 52 organic herds, 27 non-organic free range herds and 145 conventional herds were examined bacteriologically for *Salmonella*. Contrary to the expectations, the *Salmonella* prevalence was found to be higher in samples from conventional herds (10.7%) compared with samples from non-organic free range herds (4.8%) (borderline significant difference). The prevalence in samples from organic herds (7.0%) did not differ significantly from any of these (Figure 4.1).

Interviews were conducted with owners of the studied herds, and the collected herd information was used for a risk factor study on *Salmonella* in slaughter pigs. It was found that use of well-known *Salmonella*-reducing feeding and management strategies in conventional herds has increased markedly over the last 10 years and was found to be more commonly applied than in the alternative pig productions. However, in all three production systems implementation of these strategies in more herds will probably lead to a significant reduction in the occurrence of *Salmonella* in slaughter pigs.

In conventional herds, purchase of a large number of pigs, larger herd size, the choice of feed components, use of feed containing finely ground grain and change of feed type from growers to finishers may partly explain the higher prevalence of *Salmonella*. In order to obtain a lower prevalence, conventional herds should consider purchasing pigs from *Salmonella* negative herds, to increase the use of structure feed, to add organic acids to feed, to use feed with a higher content of barley and to avoid change of feed during the growing and finishing period. The results from this study further indicate that the reduced risk of *Salmonella* in the largest conventional herds is probably due to the more common use of home mixed feed and fermented wet feed in these herds.

Non-organic free range herds are relatively large and purchase pigs almost to the same extent as conventional herds. Despite their less frequent use of *Salmonella*-reducing feeding and management strategies, the lowest *Salmonella* prevalence was detected in the non-organic free range herds. This may partly be explained by the use of more barley in the feed, use of coarse feed structure in commercial feed and fewer herds changing feed between the growing and the finishing period.

Organic herds are considerably smaller and more often farrow-to-finisher productions compared with non-organic free range herds and conventional herds. In particular purchase of fewer pigs, along with a more frequent use of organic acids in the feed and coarser grinding of grain for home mixed feed, could be part of the explanation for the lower occurrence of *Salmonella* in organic herds compared with conventional herds. Compared with the non-organic free range herds, a larger proportion of the organic herds changed the feed from growers to finishers, and their use of barley and high structure in commercial feed was more limited.

Some of these measures are new and need further investigation prior to implementation in herds, but overall there seems to be a potential for further reduction of *Salmonella* in slaughter pigs in all three herd types. Important barriers are the direct or indirect expenses associated with implementation of the suggested control measures.

5. *Campylobacter* in meat from organic and conventional broilers

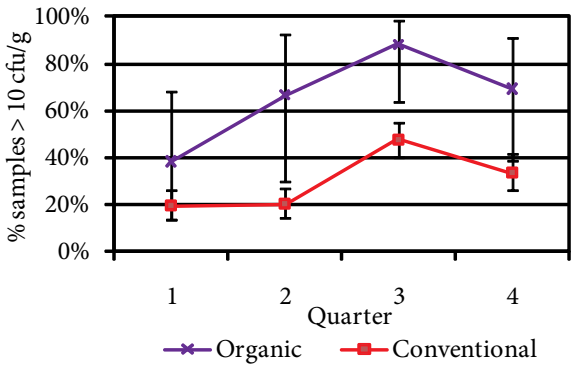
By Anne Louise Krogh (alok@food.dtu.dk), Louise Boysen and Hanne Rosenquist

The Danish action plan against *Campylobacter* initiated in 2008, requested information on the *Campylobacter* level in free range and organic broiler meat as an addition to the existing surveillance of *Campylobacter* in conventional broiler meat (for more information, see Annual Report 2007, Chapter 2). A project financed by the special guarantees for *Salmonella* and *Campylobacter* investigated the level of thermotolerant *Campylobacter* in organic broiler meat produced in Denmark in 2009-2010.

In Denmark, free range and organic broilers constituted 0.025% of the broiler production in 2009. Around 10,000 organic birds are slaughtered on a yearly basis. Free range broilers are only produced by a small number of producers of non-commercial size. Therefore, only organic broiler meat was included in the investigation as it would be impossible to collect enough free range samples for statistical analysis.

Previously, it was shown that the prevalence of *Campylobacter* was higher in organic broilers compared with conventional broilers; 100% and 37%, respectively (1). However, in relation to estimating the risk of illness from different meat types and deciding upon risk management initiatives for specific branches of production, information on the percentage of positive meat samples as well as the level of contamination will have to be available. The higher prevalence in organic broilers compared with conventional broilers may be due to the fact that organic broiler flocks are required to have access to outdoor premises and therefore are exposed to natural sources of *Campylobacter*. Furthermore, organic broilers are older than conventional broilers at slaughter, which is a risk factor; the longer the exposure to *Campylobacter*, the higher the risk of colonization.

Figure 5.1. Percent Campylobacter *positive organic and conventional broiler meat samples[a], April 2009-March 2010*



a) The lines indicate the standard deviation.
Source: National Food Institute

Danish produced organic fresh chilled meat was analysed for the number of thermotolerant *Campylobacter* by the National Food Institute. The investigation was carried out from April 1st 2009 to March 31st 2010. During this period, four carcasses from each slaughtered organic commercial broiler flock were collected by the industry. In total, 208 carcasses, representing 52 organic broiler flocks, were collected and analysed quantitatively according to the NMKL method (draft August 2004) used in the current surveillance of broiler meat at slaughterhouses. Figure 5.1 shows the percentage of organic and conventional meat samples with more than 10 *Campylobacter* per gram. The conventional broiler meat included was part of the current surveillance of *Campylobacter* at two large slaghter houses in Denmark. It was chilled meat with skin collected during the same period as the organic meat.

On average, 66% of chilled organic broiler meat samples were *Campylobacter* positive compared with 30% of the chilled conventional broiler meat samples (adjusted for season). Seasonal variation in the percentage of *Campylobacter* positive samples was seen from both production systems (Figure 5.1). As regards the average numbers of *Campylobacter* in the samples from positive flocks, no difference was observed between organic and conventional broiler meat. For the organic samples the average *Campylobacter* concentration was 1.9 ± 0.7 log cfu/g and for the conventional broiler meat it was 1.9 ± 0.8 log cfu/g.

Isolates from 84% of the positive flocks were speciated using PCR; 74.2% of the isolates were *C. jejuni*, 6.5% were *C. coli*, and 19.3% were a mixture of the two species. This is very similar to results from the surveillance of conventional broiler meat (appendix C, Table A13).

In conclusion, the survey showed that Danish produced chilled organic broiler meat was more often contaminated with *Campylobacter* than Danish produced chilled conventional broiler meat. However, there was no statistically significant difference in the average number of *Campylobacter* in meat produced by the two production systems.

References

1) Heuer, O.E., K. Pedersen, J.S. Andersen & M. Madsen, 2001. Prevalence and antimicrobial susceptibility of thermophilic *Campylobacter* in organic and conventional broiler flocks. Letter in Applied Microbiology 33: 269-274.

6. EU related topics

6.1 *Trichinella* - special status

In July 2007, the European Commission and the other Member States assigned Denmark status as a region where the risk of *Trichinella* in domestic swine is officially recognised as negligible (EU Regulation (EC) No 2075/2005).

As a result of this status, the future monitoring programme for *Trichinella* may be risk based. Slaughter pigs reared under controlled housing conditions in integrated production systems do not have to be tested for *Trichinella.* All other categories of pigs and other species (domestic or game) which can become infected with *Trichinella* will be examined in accordance with the methods laid down in Regulation (EC) No 2075/2005. Further, pork exported to third market countries will be tested for *Trichinella* unless the importing country accepts the new monitoring programme.

In order to fulfill the requirements set out by the Regulation, a monitoring programme for *Trichinella* in wildlife must be in place. Such a programme was initiated in 2008. In total, approximately 300 foxes and 50 other carnivores will be examined annually. In 2009, no *Trichinella* was found in Denmark.

6.2 Control of zoonoses in animal populations - EU baseline studies

Based on the Zoonosis Directive 2003/99/EC and Regulation (EC) 2160/2003 the Commission has so far initiated eight EU-studies – the baseline studies - of the *Salmonella* prevalence in laying hens, broilers, broiler carcasses, turkeys, breeding pigs and slaughter pigs, of the *Campylobacter* prevalence in broilers and broiler carcasses and of methicillin-resistant *Staphylococcus aureus* (MRSA) in breeding pigs. The objectives of the studies are to generate comparable prevalence data from all Member States with the purpose of setting common EU targets for the reduction of the pathogen in question. The sampling schemes and methods used in the studies are harmonized, and in 2008 two baseline studies were carried out. No baseline studies were carried out in 2009.

The prevalence results from the 2008 studies are published on the EFSA website (www.efsa.europa.eu) and analysis of the risk factors will be published at the same site in 2010.

Baseline study on the prevalence of *Salmonella* in breeding, multiplying and sow herds at the farm

In 2008, a study on the *Salmonella* prevalence was performed where pen faecal samples were collected from 95 breeding and multiplier herds and from 198 sow herds. A total of 10 pen samples were collected from each herd. One sample represented at least 10 pigs.

In breeding and multiplier herds, the prevalence of *Salmonella* in Danish herds was 41%, while the EU prevalence was 29% ranging from 0% to 64% positive herds in Member States.

In sow herds, 41% of the Danish herds were positive compared with an EU prevalence of 33%. The prevalence in the Member States ranged from 0% to 56%.

The most frequent serotypes in Danish herds were *S.* Derby (39% of isolates and 29% of positive herds), *S.* Typhimurium (21% of isolates and 29% of positive herds) and *S.* Infantis (13% of isolates and 14% of positive herds).

Baseline study on the prevalence of *Salmonella* and *Campylobacter* in broilers and on broiler carcasses at slaughter

For the study on *Campylobacter* and *Salmonella* in broilers at slaughter, each Member State was required to sample 384 batches at slaughter. From each randomly selected batch, intact caecums with content from 10 randomly selected broilers were collected for the detection of *Campylobacter*. In addition, one whole carcass was collected from each of the 384 batches for the detection and enumeration of *Campylobacter* and for the detection of *Salmonella*.

In total, 396 Danish flocks were tested and *Salmonella* was not detected in any of the flocks. The EU prevalence was 16%, ranging from 0% to 86% in Member States.

Campylobacter was detected in 76 of 396 Danish broiler flocks corresponding to a prevalence of 19%. In the EU, the prevalence in broiler flocks ranged from 4% to 100%, with an average of 71%. Further, 31% of the Danish broiler carcasses were positive for *Campylobacter*. The prevalence of *Campylobacter* on broiler carcasses in Member States ranged from 5% to 100% with an EU prevalence of 76%.

EU harmonised surveillance programmes

In 2009, Member States were for the first time obliged to report the prevalence in broiler flocks according to the Regulation (EC) 2160/2003. The EU target of 1% for flocks positive with *S.* Typhimurium and *S.* Enteritidis is based on the results of the EU baseline study carried out in 2005-2006 and decided by the Commission in 2007 (Regulation (EC) No 646/2007) (See Annual Report 2007 for an overview of Danish results). This target has to be reached by December 31st 2011. Denmark has had intensive *Salmonella* control programmes for many years and the target of 1% has already been reached. In 2009, 0.3% of the broiler flocks were positive with *S.* Typhimurium and no flocks were positive with *S.* Enteritidis.

For all breeding flocks of *Gallus gallus,* the target of 1% positive adult flocks for the five *Salmonella* serotypes Typhimurium, Enteritidis, Infantis, Virchow and Hadar had to be reached by December 31st 2009 (Regulation (EC) 1003/2005). The Regulation does not differentiate between the table egg and broiler production lines and three (1.2%) adult breeding flocks were positive with one of the five serovars in 2009 (appendix C, Table A8 and A10).

The EU baseline survey on table egg laying flocks showed very large differences in the prevalence between Member States. Therefore, a yearly reduction target has been set dependant on the prevalence of positive flocks in the member state the previous year (Regulation (EC) 1168/2006). Member States with high prevalences have the highest reduction requirements. The target is set for *S.* Typhimurium and *S.* Enteritidis, only. For Member States with a prevalence below 10% the prevalence should be reduced by 10% annually or to a maximum of 2% flocks positive with *S.* Typhimurium and *S.* Enteritidis. In Denmark, a target of maximum 2% table egg layer flocks positive for *S.* Typhimurium and *S.* Enteritidis has to be reached by December 31st 2011. Since 2004, Denmark has had 1% or less positive flocks, however in 2009, 1.7% of the flocks were positive (appendix C, Table A8).

7. Surveillance and control programmes

7.1 Surveillance of human disease

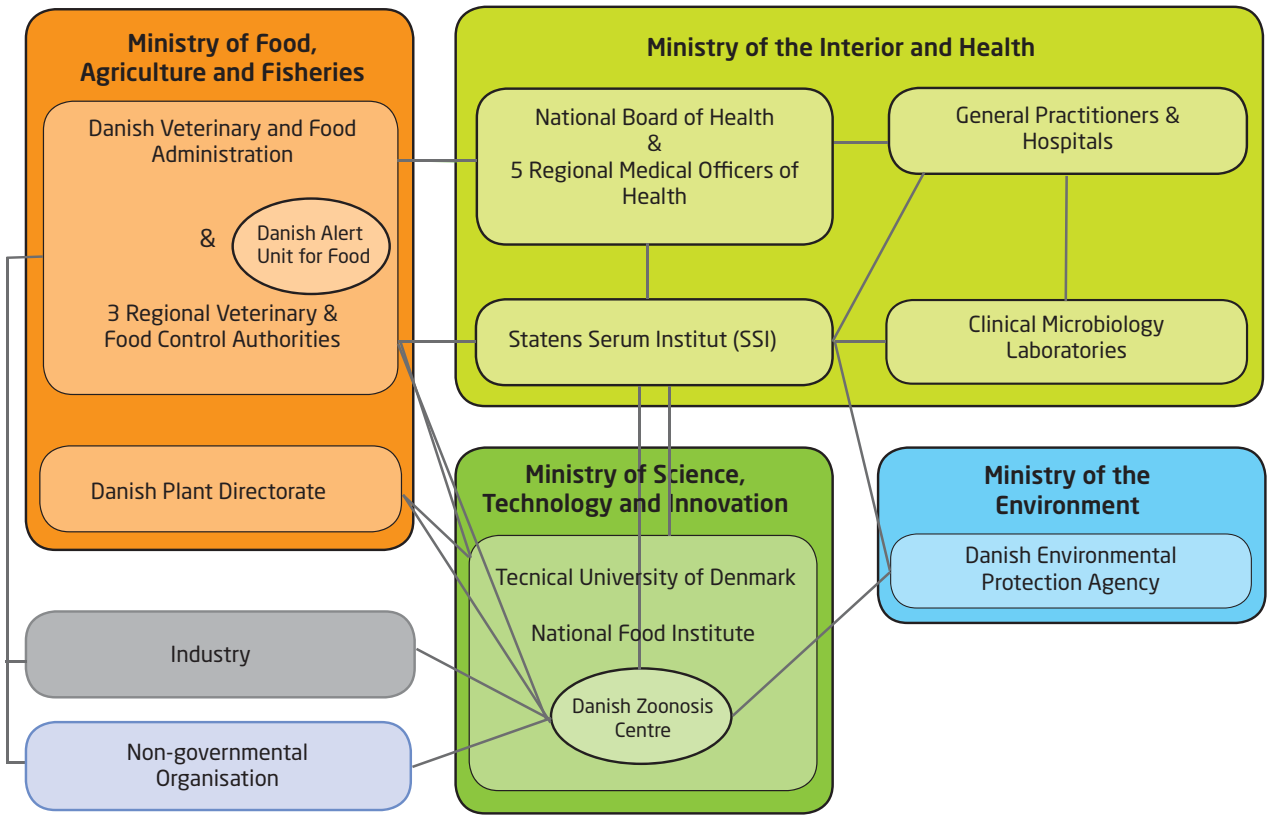
Presented in this report is the occurrence of zoonotic enteric pathogens in Denmark:

- Notifiable through the laboratory surveillance system: *Salmonella, Campylobacter*, *Yersinia*, Verocytotoxin-producing *E. coli* (VTEC) and *Listeria*
- Individually notifiable zoonotic pathogens: *Chlamydia psittacci* (ornithosis), *Leptospira, Mycobacterium,* Bovine Spongieform Encephalopathy (BSE) prions (var. Creutzfeldt-Jakob Disease), Verocytotoxin-producing *E. coli* (VTEC) and *Lyssavirus* (rabies)
- Non-notifiable zoonotic pathogens: *Brucella, Cryptosporidium, Echinococcus, Toxoplasma* and *Trichinella*.

An overview of these notifiable and non-notifiable human diseases is provided in appendix D, Table A29.

In Denmark, the physicians report individually notifiable zoonotic diseases to the medical officers and the Department of Epidemiology at Statens Serum Institut (Figure 7.1). Positive cases diagnosed by a clinical microbiological laboratory are reported through the laboratory surveillance system to the Unit of Gastrointestinal Infections at Statens Serum Institut. 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 Statens Serum Institut within one week. Furthermore, all *Salmonella* and VTEC isolates are sent to the reference laboratory at Statens Serum Institut for further sero- and genotyping. The *Salmonella* positive isolates are sent to the National Food Institute, Technical University of Denmark for phage typing (see appendix D, table 37 for more detailed information on typing methods). The results are recorded

Figure 7.1. Overview of the monitoring and outbreak investigation network for reporting infectious pathogens in humans, animals, foodstuffs and feedstuffs in Denmark



Source: Danish Zoonosis Centre, National Food Institute

Highlights from the critical review of the Danish *Salmonella* initiatives

The human incidence of salmonellosis in Denmark increased markedly in 2008 to more than twice the level reported in previous years. The majority of the rise was caused by an unusual large *Salmonella* Typhimurium U292 outbreak (see Annual Report 2008 for more information) and other large outbreaks, but there was also an increase in the number of sporadic cases.

Due to this unusual situation, The Danish Veterinary and Food Administration performed a critical review of all the Danish *Salmonella* control programmes as well as other initiatives. The review was prepared by a working group with participants from Statens Serum Institut, The Danish National Board of Health, Danish Agriculture and Food Council, Copenhagen University Faculty of Life Science, The National Food Institute, Dianova and The Danish Veterinary and Food Administration.

The review resulted in a report which contained 14 recommendations for future initiatives. It was concluded that the ongoing programmes in the poultry and cattle sectors were efficient as well as sufficient. The proposed initiatives include among others:

- New measures in the control programme for pigs and pork
- Stronger focus on non-animal sources of *Salmonella*
- Improvements of the *Salmonella* source account model and preparation of two source accounts annually
- Mandatory typing of *Salmonella* isolates from own check programmes
- Improvement of relevant measures, e.g. need for monitoring, guidance documents at meat production plants and at retail.

The report was published in October 2009 and is available in Danish at www.fvst.dk.

in the Register of Enteric Pathogens maintained by Statens Serum Institut. Positive cases are reported as episodes, i.e. each patient-infectious agent combination is only recorded once in any six-month period. Overviews of results from the Register of Enteric Pathogens are presented as follows:

- All laboratory confirmed human cases are presented in appendix B, Table A2
- Incidence of human infections with *Salmonella* is presented in appendix B, Figures A1-A3
- Incidence of human infections with *Campylobacter* is presented in appendix B, Figure A4
- Incidence of human infections with VTEC is presented in appendix B, Figure A5
- Incidence of human infections with *Yersinia* is presented in appendix B, Figure A6.

Further, additional information on human infections are presented as follows:

- The *Salmonella* sero- and phage type distributions are presented in appendix C, Tables A5-A7
- VTEC O-group distribution in humans is presented in appendix B, Table A4.

7.2 Outbreaks of zoonotic gastrointestinal infections

In Denmark, local foodborne outbreaks are typically investigated by the Regional Veterinary and Food Control Authority 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 Statens Serum Institut, the National Food Institute and the Danish Veterinary and Food Administration. These institutions may also aid in the investigation of local outbreaks. 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 Food, Agriculture and Fisheries for food and animal related diseases; and the Ministry of the Environment (along with the municipalities) for water related diseases.

Outbreaks may be detected in various ways. Individuals who experience illness related to food intake in settings such as restaurants or work place cantinas may report these incidents directly to the Regional Veterinary and Food Control Authorities. Physicians are obligated to report all suspected water- and foodborne infections to the regional medical officer, who then reports to Statens Serum Institut. Clusters of cases may be noted in the laboratory or identified at Statens Serum Institut through the laboratory surveillance system of gastrointestinal bacterial infections or through subtyping of bacterial isolates from patients.

A list of verified outbreaks (not including household outbreaks) reported to the Food- and waterborne Outbreak Database (FUD) are presented in appendix B, Table A3 and some of the more notable outbreaks are outlined in chapter 2.

Changes to the *Salmonella* control programme for pigs and pork

A new control programme for *Salmonella* in pigs and pork was adopted in the summer 2009. The programme is the fourth in line and covers the period 2009 -2013. It outlines new initiatives in herds as well as a new target for the *Salmonella* prevalence at the slaughterhouse level. The programme is based on previous programmes and consists of the following new elements:

- Duty of information of *Salmonella* status when trading live animals
- Targets for reduction in herds will follow EU initiatives
- Penalty on live trade from breeder and multiplier herds with high serology (index >10)
- Surveillance of sow herds
  - First step is a categorization based on results of samples from the herd and from herds that receive piglets from the herd in question
  - Reduction of pen samples in sow herds with high serology, as herds positive with *S.* Typhimurium, *S.* Infantis and *S.* Derby are considered positive for the following five years, unless they are able to prove themselves negative.
  - Development of surveillance system for sow herds (long term)
- Target for the prevalence of *Salmonella* on chilled carcasses at or below 1,0%
- New policy on antimicrobial resistance. Focus will be on resistance against critical important antimicrobials instead of multiresistant *S.* Typhimurium DT104 only. As a consequence of this, pen samples from slaughter pig herds with high serology will be replaced by a more general surveillance of antimicrobial resistance in the slaughter pig production.

7.3 Surveillance and control of animals and animal products

Salmonella surveillance and control programmes for poultry, pigs and cattle are presented in appendix D, Tables A31-A36. Sample analysis is performed at authorised private laboratories, the Regional Veterinary and Food Control Authorities, the National Food Institute or the National Veterinary Institute. Isolates positive with *Salmonella* are forwarded to the National Food Institute for subtyping (sero-, phage and genotyping as well as antimicrobial susceptibility testing). An overview of the methods used for subtyping is presented in appendix D, Table A37.

Overviews of results from surveillance and control of *Salmonella* are presented as follows:

- Results from the table egg production are presented in appendix C, Tables A5-A9
- Results from the broiler production are presented in appendix C, Tables A5-A6 and A10
- Results from the duck and turkey productions are presented in appendix C, Table A14
- Results from the pig production are presented in appendix C, Tables A5-A7, A15 and Figures A7-A9
- Results from the cattle production are presented in appendix C, Tables A5-A6, A16-17 and Figure A10
- Results from the feeding stuff production are presented in appendix C, Tables A20-A21
- Results from the rendering plants are presented in appendix C, Table A22
- Results from pets, zoo animals and wild life are presented in appendix C, Table A23.

Cattle herds with confirmed infections of multiresistant *S.* Typhimurium DT 104 (MR DT 104) or herds that have been in contact with herds infected with MR DT 104 are placed under official veterinary supervision. Cattle herds with confirmed infection of *S.* Dublin are subject to hygienic slaughter.

Overviews of results from monitoring of *Campylobacter* are presented as follows:

- Results from the poultry production are presented in appendix C, Tables A11 and A13
- Results from pig and cattle herds are presented in appendix C, Tables A18
- Results from pets, zoo animals and wild life are presented in appendix C, Table A23.

Pig and cattle carcasses are screened for *Mycobacterium* and *Echinococcus* during meat inspection at the slaughterhouse. Although Denmark is assigned as a region where the risk of *Trichinella* in domestic swine is negligible (see paragraph 6.1), all slaughter pigs slaughtered at export approved slaughterhouses are still examined for *Trichinella* as well as all horses slaughtered for human consumption and all wild boars. In addition, boars and bulls are tested for *Brucella* and bulls are tested for *Mycobacterium* at semen collection centres. All positive results for notifiable infectious diseases are reported to the Danish Veterinary and Food Administration. Results are presented in appendix C, Table A15-A16.

Results from the surveillance for Bovine Spongiform Encephalopathy (BSE) in cattle, Transmissible Spongiform Encephalopathy (TSE) in sheep/goat are presented in appendix C, Tables A24-A26.

Results from the monitoring of *Coxiella brunetii* (Q fever) in cattle are presented in appendix C, Table A16.

Appendix D, Table A30 gives an overview of notifiable and non-notifiable zoonoses presented in this report along with the relevant legislation.

7.4 Official testing of zoonotic pathogens in foodstuffs

In Denmark, control of pathogens in foodstuffs is coordinated both at the regional and at the central level of administration. Each Regional Veterinary and Food Control Authority is responsible for the control carried out within its own region, and the Danish Veterinary and Food Administration 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 wholesale and retail level include:
  * 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 foodborne outbreaks
  * Sampling in response to consumer complaints.

Centrally coordinated 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.

Appendix C, Table A27 provides information on the centrally coordinated projects conducted in 2009. Information on the following projects is presented:

- The intensified control of *Salmonella* and *Campylobacter* in Danish and imported meat are presented in appendix C, Table A19
- The findings of *Campylobacter* in non-heat treated meat cuts from broilers are presented in appendix C, Tables A11 and A12
- Findings of *Listeria monocytogenes* in ready-to-eat products are presented in appendix C, Table A28.

For further information consult the webpage of the Danish Veterinary and Food Administration, www.fvst.dk (in Danish).

Appendix A

Trends and sources in human salmonellosis

Table A1. Estimated no. of reported human cases and percentage of cases per major food source, travel or outbreaks, 2007-2009

Source	2009		2008		2007	
	Estimated no. of reported cases (95% credibility interval[a])	Percentage of reported cases	Estimated no. of reported cases (95% credibility interval[a])	Percentage of reported cases	Estimated no. of reported cases (95% credibility interval[a])	Percentage of reported cases
Pork	162 (127-198)	7.6	320 (277-367)	8.8	107 (59-159)	6.5
Beef	4 (3-6)	0.2	26 (16-36)	0.7	12 (2-27)	0.8
Table eggs	262 (245-280)	12.3	116 (91-143)	3.2	181 (147-217)	11.0
Broilers	7 (0-21)	0.3	47 (25-133)	1.3	12 (2-30)	0.8
Ducks	7 (0-19)	0.3	38 (2-99)	1.0	-	-
Imported pork	43 (22-66)	2.0	39 (12-70)	1.1	21 (4-46)	1.3
Imported beef	65 (47-86)	3.1	12 (3-25)	0.3	20 (10-29)	1.2
Imported broilers	30 (8-60)	1.4	191 (120-250)	5.2	61 (34-87)	3.7
Imported turkey	42 (11-74)	2.0	87 (8-151)	2.4	12 (2-29)	0.7
Imported duck	29 (10-50)	1.4	-	-	-	-
Travels	658 (647-669)	30.9	853 (843-864)	23.3	762 (731-794)	46.3
Unknown source	375 (322-422)	17.6	480 (413-547)	13.1	386 (329-441)	23.4
Outbreaks, unknown source	445	20.9	1,447	39.6	73	4.4
TOTAL	2,129		3,656		1,647	

a) The model is based on a Bayesian framework which gives 95% credibility intervals.
Source: Danish Zoonosis Centre, National Food Institute

Appendix B

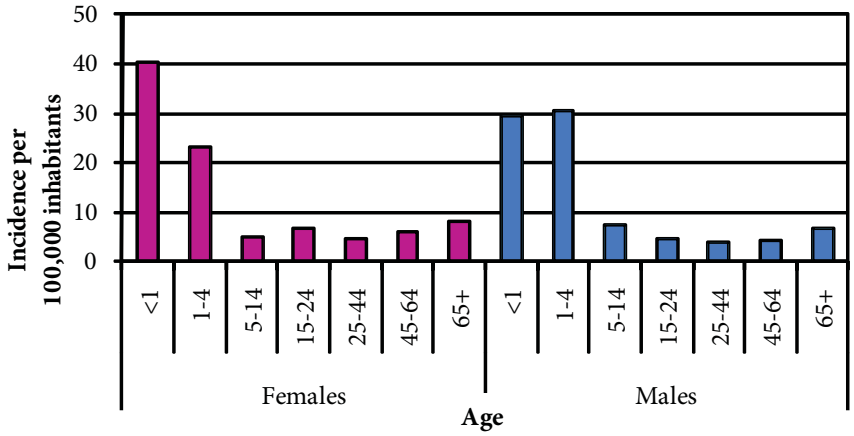
Human disease and outbreak data

Table A2. Zoonoses in humans, number of laboratory-confirmed cases, 2000-2009

	Incidence per 100,000 inhabitants	Reported no. of cases					
Zoonotic pathogen	2009	2009	2008	2007	2006	2005	2000
Bacteria							
Brucella abortus/melitensis[a,c]	-	7	8	20	9	15	-
Campylobacter coli/jejuni[b]	60.6	3,352	3,454	3,868	3,242	3,671	4,388
Chlamydia psittaci[b]	0.3	14	6	11	7	22	31
Leptospira spp.[b]	0.2	12	13	10	15	24	21
Listeria monocytogenes[b]	1.8	97	51	58	56	46	39
Mycobacterium bovis[b]	-	0	1	1	3	0	12
Salmonella total[b]	38.5	2,129	3,656	1,647	1,658	1,775	2,339
S. Enteritidis[b]	10.8	600	638	566	562	642	1,212
S. Typhimurium[b]	13.9	767	2,002	343	411	565	437
Other serotypes[b]	13.8	762	1,016	740	687	568	690
VTEC total[b]	3.0	165[f]	161	161	146	154	60
O157	0.4	24	15	25	19	25	20
other or non-typeable	2.6	141	143	136	127	129	40
Yersinia enterocolitica[b]	4.3	238	330	270	215	241	266
Parasites							
Cryptosporidium spp.[a,c]	-	35	92	49	-	-	-
Echinococcus multilocularis[a,d]	-	0	0	3	-	-	-
Echinococcus granulosus[a,d]	-	11	5	9	-	-	
Toxoplasma gondii[a,e]	-	-	-	-	14	9	13
Trichinella spp.[a,c,d]	-	0	0	1	-	-	-
Viruses							
Lyssavirus[b]	-	0	0	0	0	0	0

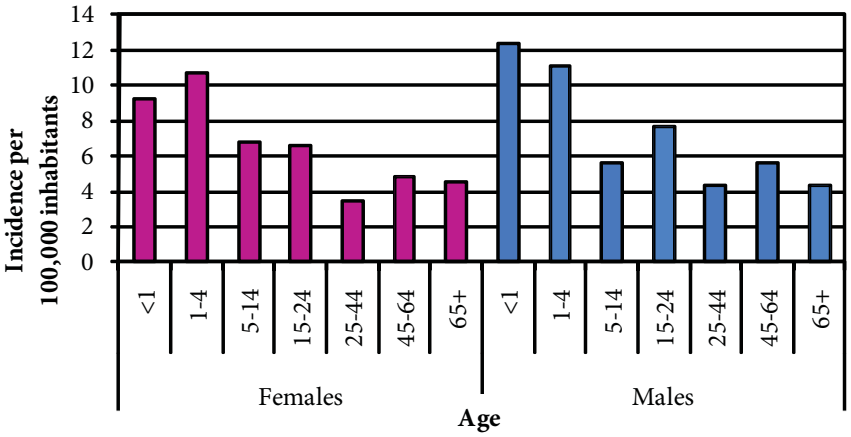
a) Not notifiable hence the incidence cannot be calculated.
b) Notifiable.
c) Data presented are from one laboratory (Statens Serum Institut) only, representing a proportion of the Danish population (approximately 1/3 in 2009). The proportion of the population represented varies from year to year, thus results from different years are not comparable. Testing for these pathogens is carried out only if specifically requested on the submission form.
d) The cases were imported.
e) The nation-wide neonatal screening for congenital toxoplasmosis stopped in 2007.
f) Not including 8 reported probable cases with no microbiological findings.
Source: Statens Serum Institut

Figure A1. Incidence of human infections with S. *Typhimurium by age and sex, 2009*



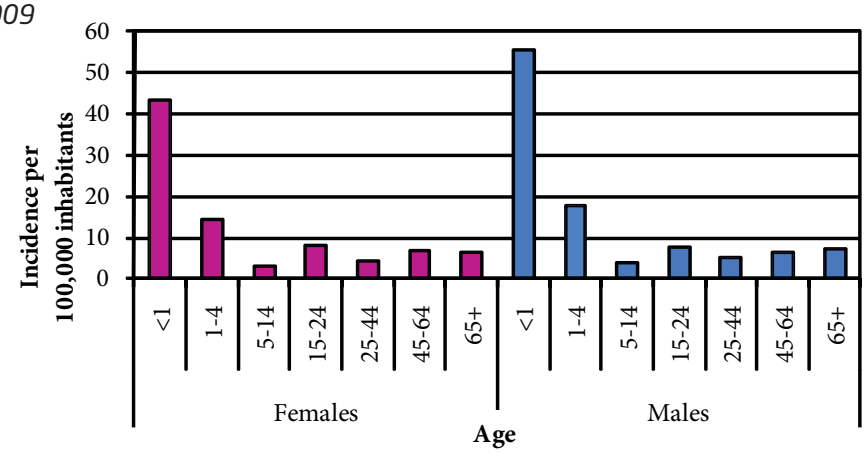
Source: Statens Serum Institut

Figure A2. Incidence of human infections with S. *Enteritidis by age and sex, 2009*



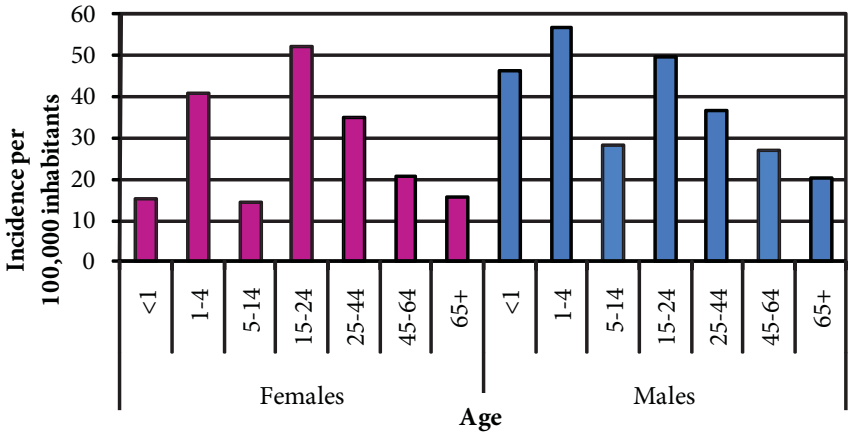
Source: Statens Serum Institut

Figure A3. Incidence of human infections with Salmonella *other than* S. *Typhimurium and* S. *Enteritidis by age and sex, 2009*



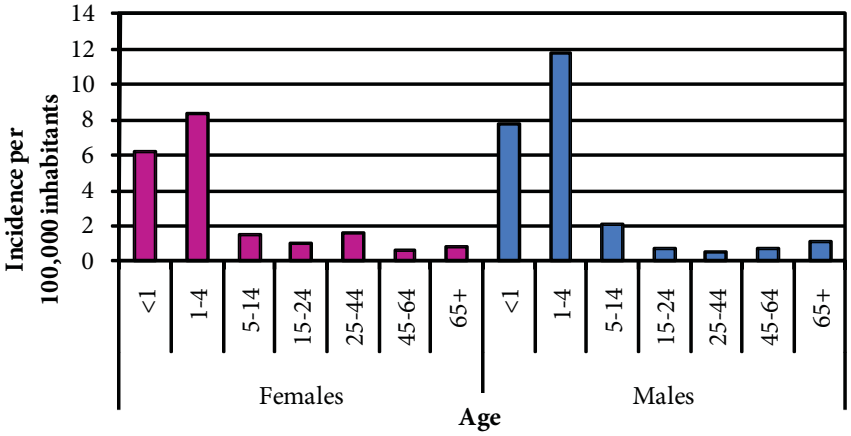
Source: Statens Serum Institut

Figure A4. Incidence of human infections with Campylobacter *by age and sex, 2009*



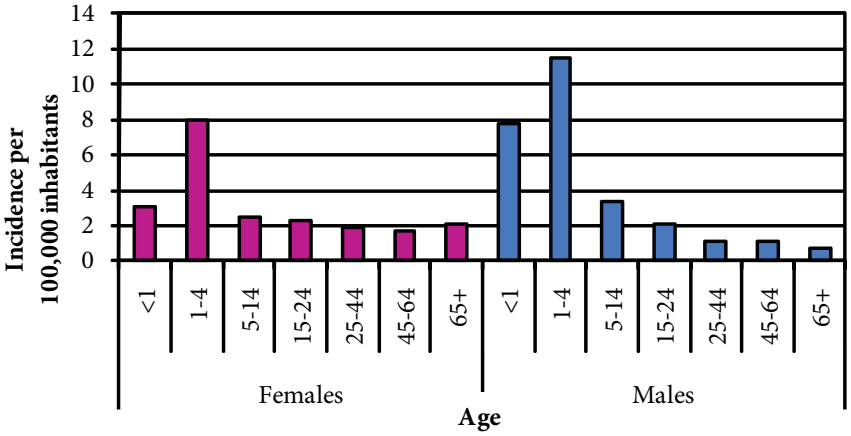
Source: Statens Serum Institut

Figure A5. Incidence of human infections with VTEC by age and sex, 2009



Source: Statens Serum Institut

Figure A6. Incidence of human infections with Yersinia *by age and sex, 2009*



Source: Statens Serum Institut

Table A3. Foodborne disease outbreaks reported in the Food- and waterborne Outbreak Database (FUD), 2009

Pathogen	No. of patients	Patients laboratory confirmed	Setting	Source	FUD no.
Bacillus cereus	13	.	Private party	Chicken	921
Bacillus cereus	48	.	Restaurant/catering	Composite meal	889
Campylobacter jejuni	2	2	School	Chicken	916
Campylobacter spp.	4	2	Restaurant/catering	Chicken	919
Campylobacter jejuni	500	39	Unknown	Water	900
Clostridium perfringens	66	.	Canteen	Chicken	865
ETEC	63	.	School	Composite meal	886
Listeria monocytogenes	8	8	Restaurant/catering	Beef	887
S. Enteritidis	4	3	Other	Unknown	871
S. Enteritidis PT 13a	.	32	General outbreak	Eggs	917
S. Enteritidis PT 13a	86	42	Swimming meet	Eggs	928
S. Enteritidis PT 6a	.	13	Abroad	Unknown	906
S. Enteritidis PT 11	.	15	Regionel outbreak	Unknown	892
S. Enteritidis PT 8	.	150	General outbreak	Eggs	891
S. Typhimurium	.	53	Regionel outbreak	Unknown	945
S. Typhimurium DT 17	.	8	General outbreak	Unknown	902
S. Typhimurium DT 135[a]	.	90	General outbreak	Unknown	854
S. Typhimurium U292[a]	.	228	General outbreak	Unknown	788
S. Typhimurium DT 3[a]	.	30	General outbreak	Unknown	883
S. Goldcoast	.	6	Abroad	Unknown	941
S. Reading	.	8	General outbreak	Unknown	914
Shigella sonnei	4	1	Private party	Molluscs/Shellfish	894
Shigella sonnei	.	10	General outbreak	Fresh vegetables	888
Yersinia	30	6	Food producer	Unknown	885
Norovirus	11	0	Restaurant/catering	Composite meal	880
Norovirus	115	7	Restaurant/catering	Buffet meals	884
Norovirus	16	.	Restaurant/catering	Person to person	851
Norovirus	7	.	Canteen	Buffet meals	947
Norovirus	120	1	Hotel	Person to person	877
Norovirus	64	2	Canteen	Buffet meals	940
Norovirus	23	.	Private party	Buffet meals	939
Norovirus	40	3	Canteen	Buffet meals	938
Norovirus	6	1	Private party	Fresh fruit	936
Norovirus	8	.	Restaurant/catering	Composite meal	924
Norovirus	5	.	Canteen	Buffet meals	922
Norovirus	19	.	Private home	Buffet meals	897
Norovirus	21	.	Private party	Buffet meals	895
Norovirus	34	5	Canteen	Buffet meals	869
Norovirus	39	.	Restaurant/catering	Buffet meals	868
Norovirus	63	3	Canteen	Person to person	901
Norovirus	12	2	Unknown	Person to person	935
Norovirus	23	0	Canteen	Person to person	862

Continued on the next page

Table A3. Foodborne disease outbreaks reported in the Food- and waterborne Outbreak Database (FUD), 2009 (Continued from page 30)

Pathogen	No. of patients	Patients laboratory confirmed	Setting	Source	FUD no.
Sapo virus	216	13	Canteen	Person to person	893
Histamin	4	.	Shop	Fish	898
Histamin	12	.	Canteen	Fish	929
Histamin	10	.	Canteen	Fish	934
Histamin	24	.	Canteen	Fish	925
Histamin	5	.	Restaurant/catering	Fish	923
Lectins	19	.	Canteen	Fresh vegetables	890
Lectins	32	.	Restaurant/catering	Composite meal	944
Other chemical substances	28	.	Canteen	Juices	870
Unknown agent	15	.	Hotel	Buffet meals	913
Total	1,819	783			

a) The outbreak started in 2008, only cases from 2009 are reported here.

Table A4. VTEC *O-group distribution in humans[a], 2009*

	Number of episodes
O157	24
O103	20
O26	11
O145	10
O146	9
O128	9
O111	7
O117	7
O91	6
O-rough	14
Other O-groups or not-typed	42
Total	159

a) All O-groups that resulted in five or more episodes are listed.
Source: Statens Serum Institut

Appendix C

Monitoring and surveillance data

Table A5. Serotype distribution (%) of Salmonella *from humans, animals, carcasses at slaughterhouse and imported meat, 2009*

	Human	Pig herds[a]	Pork[b] batch	Beef[b] batch	Layer flocks[c]	Broiler flocks[d]	Duck flocks[d]	Imported meat[e]			
								Pork	Beef	Broiler	Turkey
Serotype	N=2,129	N=388	N=156	N=11	N=8	N=33	N=54	N=43	N=5	N=41	N=69
Typhimurium	36.0	68.6	36.5	18.2	37.5	27.3	0	53.5	20.0	7.3	21.7
Enteritidis	28.2	0.5	0	0	62.5	0	0	0	20.0	19.5	0
O:4,5,12; H:i:-	2.3	0	0	0	0	0	0	0	0	0	0
Dublin	2.2	0	0	63.6	0	0	0	0	40.0	0	0
Newport	2.0	0	0	0	0	0	0	0	0	2.4	8.7
Virchow	1.7	0	0	0	0	0	0	0	0	0	4.3
Agona	1.3	0	2.6	0	0	0	0	0	0	9.8	5.8
Infantis	1.2	3.1	1.9	0	0	18.2	0	4.7	0	0	0
Saintpaul	1.1	0	0.6	0	0	0	0	0	0	0	13.0
Stanley	1.0	0	0	0	0	0	0	0	0	0	0
Others	23.1	27.8	58.3	18.2	0	54.5	100	41.9	20.0	61.0	46.4
TOTAL	100	100	100	100	100	100	100	100	100	100	100

a) Isolates obtained from sampling of slaughter pig herds placed in level 2 and 3 (See Table A36 for detailes on the surveillance programme). The isolates are biased towards herds positive with *S.* Typhimurium as the ELISA method used to analyse the meat juice samples forming the bases for assignment of herds into level 1-3 primarily focus on detection of *S.* Typhimurium antibodies.
b) Swab samples of pork and beef carcasses from the surveillance programme at slaughterhouses.
c) Represenative samples from the surveillance programme in prodution flocks.
d) Representative faecal or sock samples from the mandatory AM inspection prior to slaughter.
e) Case-by-case monitoring of imported meat and meat products, batch based.
Source: Danish Veterinary and Food Administration, Statens Serum Institut and National Food Institute

Table A6. Phagetype distribution (%) of S. Typhimurium[f] *from humans, animals and imported meat, 2009*

	Human	Pig herds[a]	Pork[b] batch	Beef[b] batch	Layer flocks[c]	Broiler flocks[d]	Imported meat[e]			
							Pork	Beef	Broiler	Turkey
Phagetype	n=767	n=266	n=57	n=2	n=3	n=9	n=23	n=1	n=3	n=15
U292	27.8	1.1	0	0	0	0	0	0	0	0
DT 135	12.6	0.4	0	0	0	0	0	0	0	0
DT 120	8.2	25.6	14.0	0	0	55.6	30.4	0	0	33.3
RDNC	5.7	14.3	7.0	0	0	22.2	4.3	0	33.3	0
DT 3	5.0	0.8	1.8	0	0	0	0	0	0	0
DT 193	4.7	6.0	5.3	0	0	0	21.7	100	0	33.3
U312	4.6	0.4	0	0	0	0	0	0	0	0
DT 170	4.4	9.0	15.8	0	0	0	0	0	0	0
DT 12	4.0	10.5	21.1	0	0	0	0	0	0	0
DT 104	3.9	4.9	3.5	0	33.3	0	8.7	0	0	20.0
Others	19.0	27.1	31.6	100	66.7	22.2	34.8	0	66.7	13.3
Total	100	100	100	100	100	100	100	100	100	100

a-e) See Table A5.
f) The total number of samples may differ between phage type and serotype tabels (Tables A5-A7), since isolates of one serotype may contain more than one phage type.
Source: Danish Veterinary and Food Administration, Statens Serum Institut and National Food Institute

Table A7. Phage type distribution (%) of S. Enteritidis[a] *from humans, animals and imported meat, 2009*

	Human	Pig herds[b]	Layer flocks[c]	Imported meat[e] Beef	Broiler
Phagetype	n=600	n=2	n=5	n=1	n=8
PT 8	34.3	50.0	40.0	100	0
PT 13A	14.0	50.0	60.0	0	0
PT 1	7.3	0	0	0	12.5
PT 21	6.5	0	0	0	12.5
PT 4	5.7	0	0	0	12.5
PT 14B	4.5	0	0	0	0
PT 6	4.0	0	0	0	0
RDNC	3.7	0	0	0	0
PT 6A	3.3	0	0	0	12.5
PT 11	2.7	0	0	0	0
Others	14.0	0	0	0	50
Total	100	100	100	100	100

a) The total number of samples may differ between phage type and serotype tabels (Tables A5-A7), since isolates of one serotype may contain more than one phage type.
b, c and e): See Table A5.
Source: Danish Veterinary and Food Administration, Statens Serum Institut and National Food Institute

Table A8. Occurrence of Salmonella *in the table egg production[a], 2000-2009*

	Rearing period (parent flocks)		Adult period (parent flocks)		Pullet-rearing flocks		Table egg layer flocks	
	N	Positive	N	Positive	N	Positive	N	Positive
2000	15	0	29	0	374	8	688	32
2001	14	0	22	0	339	4	607	35
2002	15	0	22	0	330	9	619	15
2003	24	0	15	0	367	4	611	10
2004	9	2	9	0	368	1	641	5
2005	16	0	9	0	255	6	655	7
2006	17	0	11	0	289	2	565	2
2007	11	0	12	0	326	0	510	5
2008	10	0	6	0	258	1	508	4
2009	13	0	6	0	253	0	454	8[b]

a) See Tables A31 and A33 for description of the surveillance programmes.
b) One flock positive with *S.* Typhimurium DT 40, one with *S.* Typhimurium DT 41, one with *S.* Typhimurium DT 104, two flocks positive with *S.* Enteritidis PT 8 and three with *S.* Enteritidis PT 13a. Two of the flocks positive with *S.* Enteritidis 13a belonged to the same holding, and were found positive at the same time.
Source: Danish Veterinary and Food Administration

Table A9. Occurrence of Salmonella *in the table egg layer flocks sorted by type of production, 2000-2009*

	Deep litter		Free range		Organic		Battery	
	N	Positive	N	Positive	N	Positive	N	Positive
2000	86	0	48	5	111	9	79	16
2001	122	2	46	16	137	3	129	14
2002	123	1	49	4	130	4	127	7
2003	191	2	71	2	173	1	167	9
2004	214	0	72	2	175	1	177	2
2005	217	3	70	0	178	0	175	4
2006	185	0	62	0	164	2	148	0
2007	155	2	56	0	146	2	146	1
2008	151	0	61	2	145	1	135	1
2009	133	1[a]	78	0	130	4[b]	110	3[c]

a) One flock positive with *S.* Enteritidis PT 8.
b) One flock positive with *S.* Typhimurium DT 41, one with *S.* Typhimurium DT 104, one with *S.* Typhimurium DT 40 and one with *S.* Enteritidis PT 13a.
c) One flock positive with S. Enteritidis PT 8 and two positive with *S.* Enteritidis PT 13a.
Source: Danish Veterinary and Food Administration

Table A10. Occurrence of Salmonella *in the broiler production, 2000-2009*

	Rearing period (parent flocks)		Adult period (parent flocks)		Broiler flocks		Slaughterhouse (flocks/batches)	
	N	Positive	N	Positive	N	Positive	N	Positive
2000	222	4	345	3	4,500	95	4,543	131
2001	243	0	325	7	4,571	76	1,695[a]	69
2002	241	2	330	2	4,443	68	1,667	92
2003	265	2	182[b]	4	4,414	77	1,552	77
2004	275	1	155[b]	6	4,246	64	1,472	24
2005	214	0	185[b]	0	4,034	87	1,174	27
2006	190	0	282	5	3,621	71	875[c]	17
2007	152	0	258	3	3,703	60	884	10
2008	146	0	293	2	3,845	43	518[d]	3
2009	140	0	225	4[e]	3,767[f]	35	375	3

a) PM sampling at the slaughterhouse were changed from pooled neck skin samples of flocks to chicken cuts sampling of batches.
b) In 2003-2005, only one flock per house was registered per year although there may have been more than one flock in the house, however all flocks were sampled according to the surveillance programme.
c) From 2006, data cover only samples taken following the *Salmonella* programme. 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.
d) From 2008, all AM positive flocks are heat treated at slaughter. Sampling is now carried out as verification of the AM results of the negative flocks. See Tables A31 and A32 for description of the surveillance programmes.
e) Two flocks were from the same holding and found positive at the same time. Two flocks positive with *S.* Enteritidis, one flocks positive with *S.* Typhimurium and one flock positive with *S.* Derby
f) In total, 13 flocks were positive with *S.* Typhimurium. Data includes 51 organic flocks.
Source: Danish Agriculture and Food Council and Danish Veterinary and Food Administration

Table A11. Occurrence of Campylobacter *in broiler flocks and in fresh meat at slaughter, 2003-2009*

Year	Broiler flocks[a]		Chilled broiler meat[b]	
	N	% pos	N	% pos
2003	5,373	34.2	-	-
2004	5,157	27.0	1,603	17.8
2005	4,952	30.4	1,689	12.3
2006	4,522	30.8	959	7.9
2007	4,527	26.8	439	8.2
2008	4,950	26.3	484[c]	14.7[c]
2009	4,591	29.4	1,179[d]	15.4[d]

a) Flocks investigated by cloacal swabs collected at slaughter, samples are pooled and analysed as one sample using PCR.
b) Centrally coordinated studies (see section 7.4 for describtion). Detection limit <10 cfu/g.
c) Data are not compareable with other years as they represent the last two quarters of the year, which is the high prevalent period.
d) Data are not directly comparable to previous years, as additional small slaughterhouses has been included in the monitoring. The prevalence has been weighted according to the Danish market share.
Source: Danish Veterinary and Food Administration, Danish Agriculture and Food Council and National Veterinary Institute

Table A12. Occurrence of Campylobacter *in non-heat treated broiler meat at retail[a], 2002-2009*

	Chilled broiler meat (samples)				Frozen broiler meat (samples)			
Year	Denmark		Import		Denmark		Import	
	N	% pos[b]	N	% pos[b]	N	% pos[b]	N	% pos[b]
2002-2003	403	40.8	139	78.5	324	18.3	167	24.9
2003-2004	334	27.2	170	65.7	566	10.9	272	19.6
2004-2005	517	31.1	299	73.2	937	12.2	391	25.9
2005-2006	401	29.8	854	56.3	1,087	13.5	698	31.3
2006-2007	363	31.0	1,128	51.1	897	19.0	812	33.9
2007-2008	1,058	32.8	1,067	53.9	655	29.6	577	44.4
2008-2009	1,459	33.8	1,316	46.7	847	26.1	773	27.7

a) Centrally coordinated studies, retail samples (see section 7.4 for describtion). 2000-2002: detection limit <0.4 cfu/g; 2003-2009: detection limit <0.1 cfu/g.
b) The prevalence is calculated as a mean of quarterly prevalences based on the sum of data from the two years specified.
Source: National Food Institute

Table A13. Relative distribution of Campylobacter *species (%) in broilers before slaughter[a], 2003-2009*

Year	N	*C. jejuni*	*C. upsaliensis*	*C. coli*	NT/other
2003	113	92.9	0	6.2	0.9
2004	101	94.1	0	5.9	0
2005	109	90.8	2.8	0	6.4
2006	113	92.0	0.9	7.1	0
2007	111	91.9	5.4	0.9	1.8
2008	100	90.5	2.8	0	6.6
2009	105	89.0	0	11.0	0

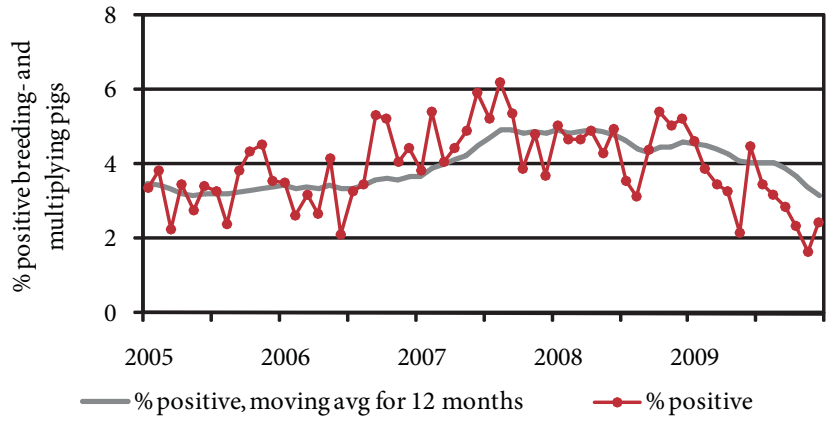
a) Positive isolates collected as part of the DANMAP programme was examined using conventional microbiological methods.
Source: National Veterinary Institute

Table A14. Occurrence of Salmonella *in turkey and duck flocks[a], 2005-2009*

	Duck flocks		Turkey flocks	
Year	N	% pos	N	% pos
2005	254	71.3	9	0
2006	266	80.5	11	0
2007	-	-	13	0
2008	68	64.7	10	10.0
2009	85	63.5	15	0

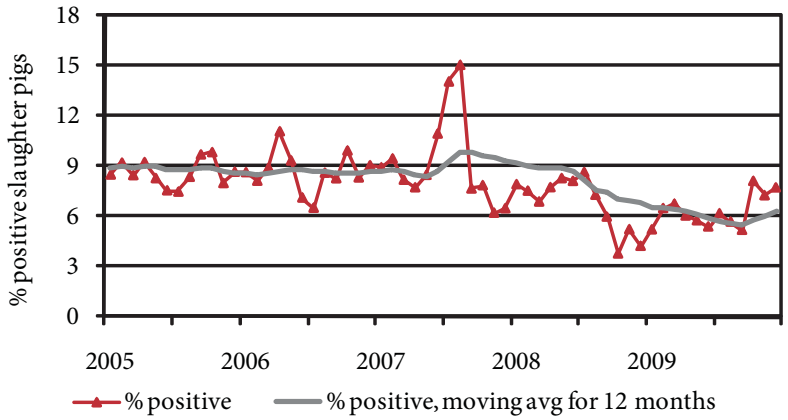
a) See Table A34 for description of the surveillance programmes. The two major turkey and duck slaughterhouses in Denmark closed down in 2004 and 2007, respectively. Therefore, most commercially reared duck and turkey flocks are transported abroad for slaughter.
Source: Danish Agriculture and Food Council

Figure A7. Serological surveillance of Salmonella *in breeding and multiplying pigs[a] based on monthly testing of blood samples, 2005-2009*



a) For more information about the surveillance programme, see Table A36
Source: Danish Agriculture and Food Council

Figure A8. Serological surveillance of Salmonella *in slaughter pigs[a], 2005-2009. Percentage of seropositive meat juice samples (first sample per herd per month)[b]*



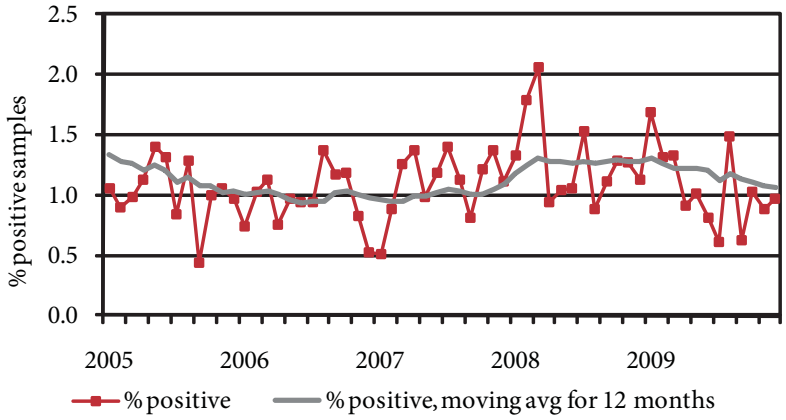
a) For more information about the surveillance programme, see Table A36
b) The peak in late summer 2007 and the very low level during 2008 were due to technical problems in the laboratory.
Source: Danish Agriculture and Food Council

Table A15. Occurrence of zoonotic pathogens in pigs in Denmark, 2009

	Herds		Animals/Samples	
Zoonotic pathogen	N	Positive	N	Positive
Salmonella spp.[a,b]	8,422	190	-	-
Brucella abortus[c]	-	-	24,717	0
Mycobacterium bovis[d]	-	-	18,972,880	0
Echinococcus[d] *granulosis/multilocularis*	-	-	18,972,880	0
Leptospira[e]	27	1	-	-
Trichinella spp.[f]	-	-	22,766,246	0

a) See Table A36 for describtion of the surveillance programme.
b) Data are from December 2009. Slaughter pig herds monitored using serological testing of meatjuice samples collected at slaughter. Herds belonging to level 2 and 3 were defined as *Salmonella* positive.
c) Including samples from boars (examined at pre-entry, every 18 month, and prior to release from semen collection centres) (14,605 samples), samples collected in connection with export (10,012 samples), import (6 samples) or fertility problems (72 samples). 5-8 ml blood samples were analysed using either the SAT, RBT, CFT or ELISA methods.
d) Slaughtered pigs were examined by slaughterhouse meat inspectors.
e) Sampling is based on suspicion of leptosporosis due to increased abortions or other reproductive problems in a herd. Samples are investigated using immunoflourescence techniques. In 2009, a total of 98 animals were tested.
f) Samples from all pigs slaughtered at export approved slaughterhouses were examined using the method described in Directive 2075/2005/EEC. In 2007, Denmark achieved official status as region with negligible risk of *Trichinella*, according to EU Regulation (EC) No 2075/2005.
Source: Danish Veterinary and Food Administration, National Veterinary Institute and National Food Institute

Figure A9. Salmonella *in pork, monitored at slaughterhouses[a,b], 2005-2009.*



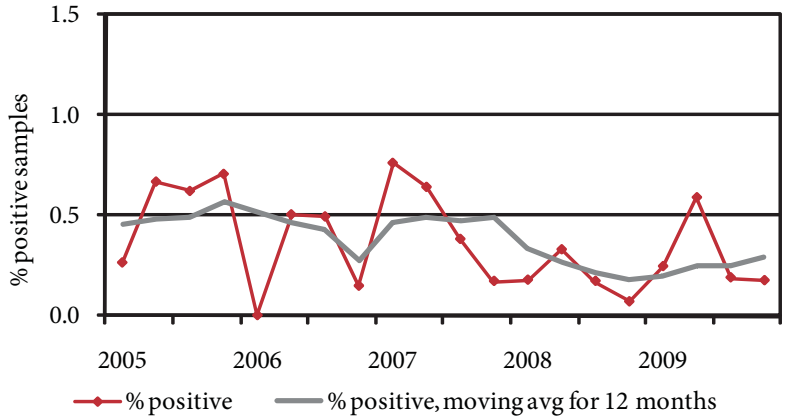
a) Swab samples taken from three designated areas of chilled half-carcasses. See Table A36 for describtion of the surveillance programme.
b) When estimating the prevalence of *Salmonella*, both the loss of sensitivity and the probability of more than one sample being positive in each pool are taken into consideration. A conversion factor has been determined on the basis of comparative studies, as described in Annual Report 2001. In 2009, a total of 24,385 samples with 1.1% positive were collected from slaughterhouses slaughtering more than 50 pigs per month, and 120 samples with 1.7% positives were analysed from slaughterhouses slaughtering less than 50 pigs per month.
Source: Danish Veterinary and Food Administration

Table A16. Occurrence of zoonotic pathogens in cattle in Denmark, 2009

	Herds		Animals/Samples	
Zoonotic pathogen	N	Positive	N	Positive
Brucella abortus[a]	-	-	2,701	0
Mycobacterium bovis[b,c]	-	-	507,200	0
VTEC O157[d]	263	23	-	-
Echinococcusus[c] *granulosis/multilocularis*	-	-	507,200	0
Coxiella brunetii	157[e]	124	111[f]	22

a) Denmark has been declared officially brucelosis free since 1979. The last outbreak was recorded in 1962. Including samples from boars (examined at pre-entry, every year, and prior to release from semen collection centres) (2.215 samples), samples collected in connection with export (329 samples) or fertility problems (77 samples). 5-8 ml blood samples were analysed using either the SAT, RBT, CFT or ELISA methods.
b) Denmark has been declared officially tuberculosis free since 1980. The last case of TB in cattle was diagnosed in 1988.
c) Slaughtered cattle were examined by the slaughterhouse meat inspectors.
d) Caecal content are tested from one animal per herd, collected at slaughter (DANMAP programme). A 25 g faecal sample from one slaughter calf per herd is examined using overnight enrichment, immunomagnetic separation method and plating on CT-SMAC plates for O157.
e) Bulk tank milk samples taken for diagnostic testing and analysed using an ELISA method.
f) Serum samples taken for diagnostic testing and analysed using an ELISA method. An additional 14 samples from placenta was analysed using the FISH method, one sample was positive.
Source: Danish Veterinary and Food Administration, National Veterinary Institute and National Food Institute

Figure A10. Salmonella *in beef, monitored at slaughterhouses*[a,b]*, 2005-2009.*



a) Swab samples taken from three designated areas of chilled half-carcasses. See Table A35 for describtion of the surveillance programme.
b) 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 2009, a total of 7,080 samples with 0.3% positive were collected from slaughterhouses slaughtering more than 50 cattle per month, and 190 samples with no positives were collected from slaughterhouses slaughtering less than 50 cattle per month.
Source: Danish Veterinary and Food Administration

Table A17. Cattle herds in the S. *Dublin surveillance programme[a], January 2010*

Salmonella Dublin level			Non-milk producing herds		Milk producing herds	
			N	%	N	%
Level 1	1a	On the basis of milk samples	1,025	7.1	3,806	90.0
	1b	On the basis of blood samples	11,851	81.7	13	0.3
	Total	Probably *Salmonella* Dublin free	12,876	88.7	3,819	90.3
Level 2	2	Titer high in blood- or milk samples	442	3.0	382	9.0
	2	Contact with herds in level 2 or 3	638	4.4	20	0.5
	2	'Non-Level 1' due to too few blood samples	3	0	3	0.1
	Total	Non *Salmonella* Dublin free	1,083	7.5	405	9.6
Level 3	Total	Salmonellosis, official supervision	1	0	5	0.1
Unknown		Too few blood samples	549	3.8	0	0
Total number of herds sampled			14,509	100	4,229	100

a) See Table A35 for describtion of the surveillance programme.
Source: Danish Veterinary and Food Administration

Table A18. Distribution of Campylobacter *(%) in pig and cattle herds[a], 2000-2009*

	Pigs				Cattle			
	N	% pos			N	% pos		
		C. coli	*C. jejuni*	other/unknown		*C. coli*	*C. jejuni*	other/unknown
2000	310	59.4	4.2	0.6	90	1.1	56.7	3.3
2001	238	68.5	2.9	5.5	76	6.6	53.9	11.8
2002	240	78.8	1.7	0	87	0	63.2	2.3
2003	259	-	-	93.4	88	-	-	63.6
2004	191	78.0	1.0	0.5	67	1.5	62.7	0
2005	185	83.2	2.2	0	73	0	42.5	0
2006	295	50.8	1.4	0	224	6.7	37.5	0
2007	261	76.6	1.9	0	132	3.0	67.4	0
2008[b]	292	66.1	1.7	-	168	3.0	58.3	-
2009	287	47.7	8.0	-	188	1.1	56.9	-

a) Samples were collected as part of the DANMAP programme. Caecal content was tested from one animal per herd.
b) From 2008, samples are only tested for *C. coli* and *C. jejuni*.
Source: National Food Institute

Table A19. Results from the intensified control of Salmonella *and* Campylobacter *in fresh meat based on a case-by-case risk assessment, 2009*

		No. of batches tested	No. of batches positive	No. of batches sanctioned	Mean prevalence in positive batches[a,b]	Mean relative human risk in positive batches[a]
Campylobacter						
Danish	Broiler	300	37	1	39.6%	3.1
Imported	Broiler	736	154	2	24.2%	1.8
	Turkey	342	48	0	14.7%	0.9
Salmonella						
Danish	Beef	126	5	3	6.7%	29.0
	Pork	304	30	6	12.3%	4.3
	Broiler	100	0	0	-	-
Imported	Beef	125	5	2	5.7%	47.6
	Pork	301	37	6	5.5%	5.6
	Broiler	736	30	7	8.7%	0.8
	Turkey	342	62	16	10.7%	0.8

a) Include positive batches where a risk assesments has been performed. Risk assesments of positive batches of marinated meat is not required, but conducted in most cases.
b) The *Salmonella* prevalence in each batch is based on the proportion of positive pooled samples (12 pools per batch) and number of subsamples per pool.
Source: Danish Veterinary and Food Administration and National Food Institute

Table A20. Feed business operators own sampling of Salmonella *in compound feeds, feed processing and feed material, 2007 and 2009*

	2009 Samples		2007 Samples	
	N	Pos	N	Pos
Feed processing plants (process control)[a]:				
Ordinary inspections - clean zone	7,781	3[d]	6,865	9
Ordinary inspections - dirty zone	340	28[e]	-	-
Compound feed, farm animals	1,339	0	424	6
Feed materials, farm animals[b]	1,061	85[f]	1,408	35
Transport vehicles, clean zone/hygiene samples[c]	1,176	1[g]	949	2
Transport vehicles, dirty zone/hygiene samples[c]	29	0	-	-

a) The presence of *Salmonella* in compound feed is indirectly monitored by the environmental samples collected during feed processing.
b) Sampling of feed materials (predominantly soy bean meal and rapeseed cake).
c) Samples from transport vehicles (hygiene samples) prior to loading of feed compounds.
d) *S.* London, *S.* Idikan, *S.* Stourbridge.
e) *S.* Agona, *S.* Banana, *S.* Cerro, *S.* Derby, *S.* Enteritidis, *S.* Falkensee, *S.* Havana, *S.* Infantis, Kentucky, *S.* Orion var 15,34, *S.* Regent, *S.* Rissen, *S.* Senftenberg, *S.* Tennessee, *S.* Westhampton.
f) *S.* 8.20:i:-, *S.* Agona, *S.* Anatum, *S.* Banana, *S.* Cerro, *S.* Cubana, *S.* Hanana, *S.* Infantis, *S.* Kentucky, *S.* Lexington var. 15,34, *S.* Livingstone, *S.* Mbandaka, *S.* Meleagridis, *S.* Ouakan, *S.* Orion var 15,34, *S.* Rissen, *S.* Senftenberg, *S.* Typhimurium.
g) *S.* Infantis.
Source: Danish Plant Directorate / the feed business operators

Table A21. Control of Salmonella *in compound feeds, feed processing and feed material, 2005-2009*

	2009 Samples		2008 Samples		2007 Samples		2006 Samples		2005 Samples	
	N	Pos	N	Pos	N	Pos	N	Pos	N	Pos
Feed processing plants (process control)[a]:										
Ordinary inspections	907	18[d]	1,085	18	976	17	1,589	31	1,885	29
Additional inspections	-	-	-	-	-	-	174	13	175	15
Feed materials, farm animals[b]	186	4[e]	174	12	71	3	336	16	1,119	72
Transport vehicles, hygiene samples[c]	-	-	3	0	95	0	191	2	254	3

a) The presence of *Salmonella* in compound feed is indirectly monitored by the environmental samples collected during feed processing. Companies are sampled one to four times per year.
b) Sampling of feed materials (predominantly soy bean meal and rapeseed cake).
c) Samples from transport vehicles (hygiene samples) prior to loading of feed compounds.
d) *S.* Adelaide, *S.* Anatum, *S.* Falkensee, *S.* Meleagridis, *S.* Putten, *S.* Senftenberg and *S.* Tennessee.
e) *S.* Infantis, *S.* Livingstone, *S.* Rissen and *S.* Senftenberg.
Source: Danish Plant Directorate

Table A22. Salmonella *in three categories of meat and bone meal by-products not intended for human consumption[a], 2009*

Category of processing plant		Own-check samples		Product samples	
		N	Positive	N	Positive
1	By-products of this material cannot be used for feeding purposes	-	-	-	-
2	By-product of this material may be used for feed for fur animals	-	-	33	0
3	By-products from healthy animals slaughtered in a slaughterhouse. Products of these may be used for petfood[b] and for feed for fur animals	601	4	1,194	3[c]
	TOTAL	601	4	1,227	3

a) Regulation No. 1774 of 03/10/2002.
b) For cats and dogs. Only by-products from pigs are used in this petfood.
c) In 2009, the percentage of positive product samples from category 3 markedly decreased to 0.3% (from 2.8% in 2008), which is the result of improved cleaning.
Source: Danish Veterinary and Food Administration

Table A23. Occurrence of zoonotic pathogens in pets, zoo animals and wild life in Denmark[a], 2009

	Pet animals						Zoo animals				Wildlife			
	Dogs		Cats		Others		Mammals & reptiles		Birds		Mammals		Birds	
Zoonotic pathogen	N	Pos	N	Pos	N	Pos	N	Pos	N	Pos	N	Pos	N	Pos
Salmonella spp.	12	0	2	0	0	-	22	3[b]	9	0	67	6[c]	47	2[d]
Campylobacter spp.	5	0	5	0	2	0	8	1[e]	2	0	91	4[f]	16	3[g]
Chlamydia psittaci	0	-	1	0	1	0	0	-	10	0	0	-	0	-
Cryptosporidium spp.	27	2	17	2	0	-	22	1[h]	2	0	53	8[i]	0	0
Echinococcus spp.	0	-	0	-	0	-	0	0	0	0	21	0	0	0
Trichinella spp.[j]	0	-	0	-	0	-	0	-	0	-	265[k]	0	34	0
Lyssavirus (classical)	2	0	1	0	2	0	0	-	0	-	0	-	0	-
European Bat *Lyssavirus*	0	-	0	-	0	-	0	-	0	-	9[l]	1[m]	0	-

a) All samples are analysed based on suspision of disease and does not reflect the country prevalence.
b) 1 pink tounge skink, 1 Brazilian rainbow boa, 1 Indian python.
c) 1 fox, 4 European hedgehogs, 1 mink.
d) 1 common buzzard, 1 greylag goose.
e) 1 Zebra.
f) 4 roe deer.
g) 2 hooded crows, 1 dowe.
h) 1 Galapagos tortoise.
i) 2 roe deer, 2 European hedgehogs, 3 squirrels, 1 racoon dog.
j) In 2007, Denmark achieved official status as region with negligible risk of *Trichinella*, according to EU Regulation (EC) No 2075/2005.
k) 139 fox, 8 badgers, 79 minks, 23 raccoon dogs and 16 other.
l) One bat was not suitable for testing.
m) Bat tested positive for EBLV-1.
Source: National Veterinary Institute

Table A24. The Bovine Spongiform Encephalopathy (BSE) surveillance programme[a] for cattle, 2009

Type of surveillance	N[b]	Positive
Active surveillance		
Healthy slaughtered animals (>30 month)	133,374	1[c]
Risk categories:		
Emergency slaugthers (>24 month)	566	0
Slaughterhouse antemortem inspection revealed suspicion or signs of disease (>24 month)	9	0
Fallen stock (>24 month)	25,047	0
Animals from herds under restriction	4	0
Passive surveillance		
Animals suspected of having clinical BSE	2	0
Total	159,002	1

a) According to the EU Regulation (EC) 999/2001 as amended and Commission Decision 2009/719/EC as amended
b) Samples (brain stem material) are tested using a IDEXX technique or Prionics-Check PrioStrip. Confirmatory testing is carried out using Western blot (definitive diagnosis if positive case), else with histopathology or immunohistochemistry. Further confirmation on autolysed material is performed at the Community TSE reference laboratory.
c) One 14 year old cow positive with classical BSE, probably infected by a BSE positive feed batch distributed in Denmark in 1996. This batch caused an outbreak of classical BSE during 2000-2003 and a risk model developed by the National Veterinary Institute predicted that one or two cases of classical BSE probably could occur as long as animals from the cohort are still alive.
Source: Danish Veterinary and Food Administration

Table A25. The Transmissible Spongiform Encephalopathy (TSE) surveillance programme for sheep and goats, 2009

Type of Surveillance	N[a]	Positive
Active surveillance		
Fallen stock (>18 mo.)	7,880	0
Healthy slaughtered animals (>18 mo.)	0	0
Animals from herds under restriction	0	0
Passive surveillance		
Animals suspected of having clinical TSE	3	0
Total	7,883	0

a) Samples (brain stem material) are tested using a IDEXX technique or Prionics-Check Prio-Strip. Confirmatory testing is carried out using Western blot (definitive diagnosis if positive case), else with histopathology or immunohistochemistry. Further confirmation on autolysed material is performed at the Community TSE reference laboratory.
Source: Danish Veterinary and Food Administration

Table A26. Distribution[a] (%) of prion protein genotype of sheep randomly selected, 2009

	Genotype	Sheep n=102
NSP 1	ARR/ARR	20.6
NSP 2	ARR/AHQ	4.9
	ARR/ARQ	12.7
	ARR/ARH/Q	2.0
NSP 3 (ARQ/ARQ)	ARQ/ARQ	49.0
NSP 3 (Other)	AHQ/AHQ	0
	ARH/ARH	0
	ARQ/ARH	0
	ARQ/AHQ	5.9
NSP4	ARR/VRQ	0
NSP5	ARQ/VRQ	4.9
Total		100

a) The genotypes were grouped in the NSP classification system according to their different susceptibility: NSP 1: Genetically most resistant, NSP 2: Genetically resistant, NSP 3: Genetically little resistance, NSP 4: Genetically susceptible, and NSP 5: Genetically highly susceptible.
Source: National Veterinary Institute

Table A27. Centrally coordinated studies conducted in 2009

Title of project	No. of samples	Bacteria analysed per sample (regional laboratories)	Futher information
Salmonella and *Escheridia coli* in prepared boiled bivalved molluscs from Greenland	50	*Salmonella, E. coli*	Results are being processed
Listeria monocytogenes, *Salmonella*, *E. coli* and *Staphylococcus* in fish products from Greenland	50	*Salmonella, E. coli, Staphylococcus, L. monocytogenes*	Results are being processed
Microbiological classification of the production areas for bivalve molluscs	20	*Salmonella*, *E. coli*, viruses	Results are being processed
Antimicrobial resistance in Danish and imported broiler meat, beef and pork	1,000	*Salmonella, E. coli, Campylobacter, Enterococcus*	Results are being processed
MRSA and ESC in Danish pork meat	1,700	*E. coli, S. aureus*	Results are being processed
Campylobacter in fresh, chilled Danish broiler meat	1,200	*Campylobacter*	Appendix C, Table A11
Campylobacter in fresh chilled and frozen Danish and imported broiler meat	2,800	*Campylobacter*	Appendix C, Table A12
Salmonella and *Campylobacter* in fresh chilled imported duck and turkey meat	1,200	*Campylobacter*	Results are being processed
Intensified control for *Salmonella* and *Campylobacter* in fresh Danish meat	725[a]	*Salmonella, Campylobacter*	Appendix C, Table A20
Intensified control for *Salmonella* and *Campylobacter* in fresh imported meat	1,500[a]	*Salmonella, Campylobacter*	Appendix C, Table A20
Salmonella Dublin in Danish dairy herd	75	*Salmonella*	Results are being processed
Samples of different origin related to human outbreak of *Salmonella* Typhimurium U292	3,000	*Salmonella*	Continues in 2010
Pathogens in Danish and imported slightly preserved fermented sausages	500	*Salmonella, E. coli O157* (beef products), *L. monocytogenes, enterobactericeae, enterococcus*	Continues in 2010
Pathogens in slightly preserved sliced meat (ready to eat)	260	*Salmonella, E. coli, S. aureus, L. monocytogenes*	
Microbiological quality of meat products with risk of recontamination	1,300	*E. coli, S. aureus*	Continues in 2010
Microbiological quality of cream cakes	1,400	*E. coli, B. cereus*	Results are being processed
Microbiological quality of minced meat	750	*Salmonella, E.coli*	Results are being processed
Microbiological quality of icecream and the water used for storing the spoons	700	*E. coli, B. cereus*	Results are being processed
Hygiene quality and microbiological quality of sliced meat products	400	*E. coli, Listeria*	Results are being processed
Microbiological quality of meals ready to eat	495	*B. cereus, C. perfringens, S. aureus*	Continues in 2010

Continued on the next page

Table A27. Centrally coordinated studies conducted in 2009, continued from page 44

Title of project	No. of samples	Bacteria analysed per sample (regional laboratories)	Futher information
Pathogens in Danish and imported vegetables (ready to eat)	1,500	*Salmonella, E. coli, Campylo-bacter*	Continues in 2010
Meat preparations produced at the retailers	600	*Salmonella, E. coli.*	Results are being processed
Pistacio nut and kernels	100	*Salmonella*	Results are being processed
Listeria monocytogenes in smoked fish and gravad fish	300	*L. monocytogenes*	Results are being processed

a) Batches

Source: Danish Veterinary and Food Administartion and National Food Institute

Table A28. Listeria monocytogenes *in ready-to-eat foods[a], 2009*

		Samples analysed by a qualitative method[c]				Samples analysed by a quantitative method[d]			
		Batches[b]		Single samples		Batches[b]		Single samples	
Food category	Sampling place	N	Pos	N	Pos	N	Pos	N	Pos
Products of meat origin,RTE	At processing	2	1	3	0	3	0	-	-
	At retail	-	-	1	0	1	0	12	0
Cheese, RTE									
Danish	At processing	3	0	-	-	-	-	-	-
Import	At processing	-	-	-	-	2	0	-	-
Milk and dairy products, RTE									
Danish	At processing	17	0	-	-	-	-	-	-
Import	At processing	1	0	-	-	-	-	-	-
Fishery products, RTE	At processing	1	1	-	-	14	0	-	-
	At retail	-	-	-	-	-	-	2	0
Other RTE products	At processing	-	-	1	0	-	-	-	-
	At retail	-	-	-	-	-	-	5	0

a) Samples are collected by the Regional Veterinary and Food Control Authorities according to European Regulation (EC) No 2073/2005.

b) 5 samples pooled together.

c) *Listeria monocytogenes* present in a 25 g sample of the the product.

d) Detection limit is 10 cfu/g. cfu: Coloni forming units.

Source: Danish Veterinary and Food Administration

Appendix D

Monitoring and surveillance programmes

Table A29. Overview of notifiable and non-notifiable human diseases presented in this report, 2009

Patogen	Notifiable in humans	Notification route
Bacteria		
Brucella spp.	no	-
Campylobacter spp.	1979[a]	Laboratory[b]
Chlamydophila psittaci (Ornithosis)	1980[a]	Physician[c]
Listeria monocytogenes	1993[a]	Physician
Leptospira spp.	1980[a]	Physician
Mycobacterium bovis/ tuberculosis	1905[a]	Physician (and laboratory[d])
Coxiella burnetii	no	-
Salmonella spp.	1979[a]	Laboratory
VTEC	2000[a]	Physician and laboratory
Yersinia enterocolitica	1979[a]	Laboratory
Parasites		
Cryptosporidium spp.	no	-
Echinococcus multilocularis	no	-
Echinococcus granulosus	no	-
Toxoplasma gondii	no	-
Trichinella spp.	no	-
Viruses		
Lyssavirus (Rabies)	1964[a]	Physician (via telephone)
Prions		
TSE	-	-
BSE/Creutzfeld Jacob	1997[a]	Physician

a) Danish order no. 277 of 14/04/2000. Cases must be notified to 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.
Source: Statens Serum Institut

Table A30. Overview of notifiable and non-notifiable animal diseases presented in this report, 2009

Patogen	Notifiable in animals	EU legislation	Danish legislation
Bacteria			
Brucella spp.	1920[a]		
Cattle	OBF in 1979[b]	Decision 2004/320/EC	Order no 305 of 3/5 2000
Sheep and goats	ObmF in 1995[c]	Decision 2004/320/EC	Order no. 739 of 21/8 2001
Pigs	No cases since 1999	Directive 2003/99/EC	Order no. 205 of 28/3 2009
Campylobacter spp.	no	-	-
Chlamydophila psittaci	1920	-	
Birds and poultry			Order no. 78 of 30/1 1997
Listeria monocytogenes	no	-	-
Leptospira spp. (only in production animals)	2003	-	Act no. 432 of 09/06/2004
Mycobacterium bovis/tuberculosis	1920[a]		
Cattle	OTF since 1980[d]	Decision 2004/320/EC	Order no. 1417 of 11/12 2007
Coxiella burnetii	2005	-	Act no. 432 of 09/06/2004
Salmonella spp.	1993[e]	-	
Cattle/swine			Order no. 112 of 24/02/2005
Poultry			Order no. 1010 of 24/10/2005
VTEC	no	-	-
Yersinia enterocolitica	no	-	-
Parasites			
Cryptosporidium spp.	no	-	-
Echinococcus multilocularis	2004	Council directive 64/433/EC	Act no. 432 of 09/06/2004
Echinococcus granulosus	1993	Council directive 64/433/EC	Act no. 432 of 09/06/2004
Toxoplasma gondii	no	-	-
Trichinella spp.	1920[a]	Regulation 2075/2005/EC	Circular no. 9466 of 12/07/2006
Viruses			
Lyssavirus	1920	-	Order no. 14 of 11/01/1999 and Order no. 914 of 15/12/1987
Prions			
TSE			
Sheep and goats	yes	Regulation 999/2001/EC (as amended)	Order no. 930 of 07/09/2006
BSE			
Cattle	yes	Regulation 999/2001/EC (as amended)	Order no. 800 of 13/07/2006

a) Clinical cases, observations during the meat inspection at the slaughterhouse, positive blood samples or finding of agens are notifiable.
b) Officially Brucellosis Free (OBF) according to Council Directive 64/432/EC as amended and Commision Decision 2004/320/EC. No cases in cattle since 1962.
c) Officially *B. melitensis* Free (ObmF) according to Council Directive 91/68/EC and Commision Decision 2004/320/EC. Never detected in sheep or goat.
d) Officially Tuberculosis Free (OTF) according to Council Directive 64/432/EC as amended and Regulation (EC) 1226/2002, and Commission Decision 2003/467/EC. No cases in cattle since 1988 or in deer since 1994.
e) Only clinical cases notifiable.
Source: Danish Veterinary and Food Administration

Table A31. Salmonella *surveillance programme for the rearing flocks and adult flocks of the grandparent and parent generation of the broiler and table egg production, 2009*

Time	Samples taken	Material	Material
Rearing flocks		*Grandparent generation*	*Parent generation*
Day-old[a,b]	Per delivery	5 transport crates from one delivery: crate liners (>1m² in total) or swab samples (>1m² in total). Analysed as one pool.	5 transport crates from one delivery: crate liners (>1m² in total) or swab samples (>1m² in total). Analysed as one pool.
1st & 2nd week[b, c]	Per unit[d]	-	2 pairs of boot swabs (analysed as one pooled sample) or 1 faeces sample of 60g.
4th week[a,b]		5 pairs of boot swaps (analysed as two pooled samples), or 1 faeces sample consisting of 2x150g.	2 pairs of boot swabs (analysed as one pooled sample) or 1 faeces sample of 60g.
8th week[b,c]	Per unit	2 pairs of boot swabs (analysed as one pooled sample). Cage birds: 60 samples of fresh droppings (1g). Analysed as one pool.	2 pairs of boot swabs (analysed as one pooled sample). Cage birds: 60 samples of fresh droppings (1g). Analysed as one pool.
2 weeks prior to moving[a,e]	Per unit	5 pairs of boot swabs (analysed as two pooled samples), or 1 faeces sample consisting of 2x150g.	2 pairs of boot swabs (analysed as one pooled sample) or 1 faeces sample of 60g.
Adult flocks		*Grandparent generation*	*Parent generation*
Every two weeks[b] (Every 16th week[d])[f]	Per flock	Hatcher basket liners from 5 baskets (>1m² in total) or 10g of broken eggshells from each of 25 hatcher baskets (reduced to 25g sub-sample). Analysed as one pool.	Hatcher basket liners from 5 baskets (>1m² in total) or 10g of broken eggshells from each of 25 hatcher baskets (reduced to 25g sub-sample). Analysed as one pool.
After each hatch[b]	Per hatch	Wet dust samples. Up to four hatchers of the same flock can be pooled.	Wet dust samples. Up to four hatchers of the same flock can be pooled.
Every week[b]	Per unit	-	2 pairs of boot swabs (analysed as one pooled sample) or 1 faeces sample of 60g.
0-4 weeks after moving, 8-0 weeks before slaughter[e]	Per unit	5 pairs of boot swabs (analysed as two pooled samples), or 1 faeces sample consisting of 2x150g.	5 pairs of boot swabs (analysed as two pooled samples), or 1 faeces sample consisting of 2x150g.
After positive findings[e]	Per unit	5 pairs of boot swabs (analysed as two pooled samples), 2 dust samples (250 ml) and 5 birds (analysed for antimicrobial substances.	5 pairs of boot swabs (analysed as two pooled samples), 2 dust samples (250 ml) and 5 birds (analysed for antimicrobial substances.

a) Sampling requirements set out by Regulation (EC) 2160/2003.
b) Samples collected by the food business operator.
c) Order no 1259 of 15/12/2008.
d) A unit (house) may harbour part of a flock or more than one flock, depending on the size of the unit.
e) Samples collected by the Regional Veterinary and Food Control Authorities.
f) When eggs from a flock exceed the capacity of one incubator, each incubator should be sampled as described.
Source: Danish Veterinary and Food Administration

Table A32. Salmonella *surveillance programme[a] for the broiler flocks, 2009*

Time	Samples taken	Material
Broiler production		
15 - 21 days before slaughter, Ante mortem (AM)[b,c]	Per flock	5 pairs of boot swabs. Analysed individually.
7 - 10 days before slaughter, Ante mortem (AM)[d]	Per flock	5 pairs of boot swabs. Analysed individually.
After slaughter, Post mortem (PM)[b]	Per batch	Sampling is depending on whether the slaughterhouse slaughters only AM-negative flocks or AM-negative as well as AM-positive flocks.

a) According to Order no 1261 of 15/12/2008.
b) Samples collected by the food business operator.
c) Once a year, the samples are collected by the Regional Veterinary and Food Control Administration.
d) Samples are collected by a representative of the slaughterhouse, laboratorium or the Regional Veterinary and Food Control Administration.
Source: Danish Veterinary and Food Administration

Table A33. Salmonella *surveillance programme for the pullet-rearing, table egg layer and barnyard/hobby flocks in the table egg production, 2009*

Time	Samples taken	Material
Pullet- rearing		
Day-old[a,d]	Per delivery	5 transport crates from one delivery: Crate liner (> 1 m^2 in total) or swab samples (> 1 m^2 in total) (Analysed as one pooled sample).
4 weeks old[b,d]	Per flock	5 pairs of boot swabs (analysed as two pooled samples) or 5 faeces samples of 60 gram.
2 weeks before moving[a,c]	Per flock	5 pairs of boot swabs (analysed as two pooled samples) or 5 faeces samples of 60 gram. 60 blood samples (serology).
Table egg layers (Production for certified packing stations)		
24 weeks old[a,c]	Per flock	2 pairs of boot swabs (analysed as one pooled sample) or 1 faeces sample consisting of 2x150 gram. 250 ml (100 g) dust or 1 pair of boot swabs. 60 eggs[b] (serology).
Every 9 weeks[d,e]	Per flock	2 pairs of boot swabs (analysed as one pooled sample) or one faeces sample consisting of 2x150 gram. 60 eggs[b] (serology).
Barnyard and hobby flocks		
Every 18 weeks[d]	Per folck	Egg samples.

a) Sampling requirements set out by Regulation (EC) 2160/2003.
b) According to Order no 1260 of 15/12/2008.
c) Samples collected by the Regional Veterinary and Food Control Administration.
d) Samples collected by the food business operator.
e) According to Regulation (EC) 2160/2003 sample collection must be carried out every 15 weeks as a minimum.
Source: Danish Veterinaty and Food Administration

Table A34. Salmonella *surveillance programmes[a] for the duck and turkey flocks, 2009*

Time	Samples taken	Material
Duck production		
Max. 21 days before slaughter, Ante mortem (AM)[b]	Per flock	2 pairs of boot swabs. Analysed individually.
Turkey production		
Max. 21 days before slaughter, Ante mortem (AM)[b]	Per flock	5 pairs of boot swabs. Analysed individually.

a) According to Order no 1261 of 15/12/2008.
b) Samples collected by the food business operator.
Source: Danish Veterinary and Food Administration

Table A35. Salmonella *Dublin surveillance programme[a] for the cattle herds and* Salmonella *surveillance programme at slaughter, 2009*

No. of samples	Samples taken	Comment
Milk producing herds		
4 samples distributed over 13 months	Tank milk samples	Calculation of herd level[b]
8 samples	Blood samples	If the owner wants a herd moved from level 2 to 1b
Non-milk producing herds		
1 sample[c]	Blood samples	Calculation of herd level[b]
4-8 samples	Blood samples	If the owner wants a herd moved from level 2 to 1b[d]
Beef carcasses at the slaughterhouse		
5 samples daily, pooled into one analysis	Swab samples from 3 designated areas after 12 hours chilling (3-100m^2)	Slaughterhouses slaughtering more than 200 cattle per day
5 samples per 200 slaughtered cattle, pooled into one analysis	Swab samples from 3 designated areas after 12 hours chilling (3-100m^2)	Slaughterhouses slaughtering more than 200 cattle per month or 200 or less cattle per day
5 samples every 3rd month, pooled into one analysis	Swab samples from 3 designated areas after 12 hours chilling (3-100m^2)	Slaughterhouses slaughtering 50-200 cattle per month
1 sample every 3rd month	Swab samples from 3 designated areas after 12 hours chilling (3-100m^2)	Slaughterhouses slaughtering less than 50 cattle per month

a) Order no. 112 of 24/02/2005 as ammended
b) Herd levels based on serological testing (blood and milk). Level 1a: Milk producing-herd assumed free of infection (based on tank milk samples), Level 1b: Non-milk producing-herd assumed free of infection, Level 2: Herd not assumed free of infection, Level 3: Herd infected, and Unknown level: insufficient number of blood samples have been taken from herd and no samples had antibody levels above the limit value.
c) No samples are taken, if the herd has been tested for *S.* Dublin within the last 120 days or 8 samples have been tested within the last 12 months.
d) Number of samples equals total number of animals in the herd minus 2 (max. 8 animals, min. 4 animals).
Source: Danish Veterinary and Food Administration

Table A36. Salmonella *surveillance programme for the pig production, 2009*

Time	Samples taken	Purpose
Breeding and multiplier herds		
Every month	10 blood samples per epidemiological unit	Calculation of *Salmonella*-index based on the mean from the last three months with most weight to the result from the more recent months (1:3:6)
Max. twice per year	Herds with *Salmonella*-index 5 or above: Pen-faecal samples[a]	Clarify distribution[b] and type of infection in the herd
Sow herds		
When purchaser of piglets is assigned to level 2 or 3, max. twice per year	Pen-faecal samples	Clarify distribution[b] and type of infection in the herd, and clarify possible transmission from sow herds to slaughter pig herds
Slaughter pig herds		
At slaughter	Meat juice, 60-100 samples per herd per year. Herds in RBOV[a,c]: one meat juice sample per month	Calculation of slaughter pig index based on the mean from the last three months with most weight to the result from the most recent month (1:1:3). Assigning herds to level 1-3 and assigning herds to risk-based surveillance (RBOV)[d]
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		
5 samples daily, pooled into one analysis	Swab samples from 3 designated areas (3x100 cm^2) after min. 12 h chilling	Slaughterhouses slaughtering more than 200 pigs per day
5 samples per 200 slaughtered pig, pooled into one analysis	Swab samples from 3 designated areas (3x100 cm^2) after min. 12 h chilling	Slaughterhouses slaughtering more than 200 pigs per month or 200 or less pigs per day
5 samples every 3rd month, pooled into one analysis	Swab samples from 3 designated areas (3x100 cm^2) after min. 12 h chilling	Slaughterhouses slaughtering more than 50 pigs per month or less than 200 pigs per month
1 sample every 3rd month	Swab samples from 3 designated areas (3x100 cm^2) after min. 12 h chilling	Slaughterhouses slaughtering less than 50 pigs per month

a) Herds with index above 10 have to pay a penalty for each pig sold.
b) Producers are paid a reduced price per animal in herds with *Salmonella*-index higher than 5. Pigs from herds in Level 3 must be slaughtered under special hygienic precautions.
c) The herd owner must inform buyers of breeding animals about the infection level and type of *Salmonella*.
d) RBOV: risk-based surveillance where the sample size in herds with a SP-index of zero (no positive samples in the previous three months) are reduced to one sample per month.
Source: Danish Veterinary and Food Administration

Table A37. Typing methods used in the surveillance of foodborne pathogens in Denmark, 2009

Methods		Isolates	
	Human[a]	Food	Animal
Salmonella			
Serotype	All	All	All
Phage type	*S.* Typhimurium and *S.* Enteritidis	*S.* Typhimurium and *S.* Enteritidis	*S.* Typhimurium and *S.* Enteritidis
Antimicrobial resistance	*S.* Typhimurium, 50% of *S.*Enteritidis, approx. 90% of other serotypes	*S.* Typhimurium and occasionally other serotypes	*S.* Typhimurium and occasionally other serotypes
MLVA	*S.* Typhimurium	*S.* Typhimurium (outbreak investigations)	*S.* Typhimurium (outbreak investigations)
PFGE	Outbreak investigations	Outbreak investigations	Outbreak investigations
Campylobacter coli/jejuni			
Antimicrobial resistance	Isolates from 3 districts for DANMAP surveillance	Only for DANMAP surveillance purposes	Only for DANMAP surveillance purposes
PFGE	Outbreak investigation	None	None
MLST	Outbreaks investigaions, research	None	None
VTEC			
Serotype	All	All	All
Virulence profile	All	All	All
PFGE	All	None	None
Listeria			
Serogroup	All	None	None
PFGE	All	None	None
Yersinia enterocolitica			
O-group	Isolates from one district	None	None

a) The number of laboratory-confirmed cases of zoonoses in humans is shown in appendix B, Table A2.
Source: Statens Serum Institut and Danish Zoonosis Laboratory, National Food Institute

Appendix E

Population and slaughter data

Table A38. Human population, 2009

Age groups (years)	Males	Females	Total
0-4	167,172	158,895	326,067
5-14	345,871	329,380	675,251
15-24	346,375	331,088	677,463
25-44	738,150	728,155	1,466,305
45-64	745,971	740,822	1,486,793
65+	399,747	503,112	902,859
Total	2,743,286	2,791,452	5,534,738

Source: Statistics Denmark

Table A39. Number of herds/flocks, livestock and animals slaughtered, 2009

	Herds/flocks[a]	Livestock[a] (capacity)	Number slaughtered
Slaughter pigs (>30 kg)	8,569	6,657,061	18,972,880
Cattle	22,479	1,626,528	507,200
Broilers	578	21,993,093	100,132,000
Layers (excl. barnyard)	288	3,020,000	-
Turkeys	49	486,839	7,588
Sheep & lambs	8,738	164,857	89,987
Goats	3,626	25,799	2,073
Horses	-	-	2,863

a) March 2010.

Source: The Central Husbandry Register, Statistics Denmark and Danish Veterinary and Food Administration

Table A40. Number of farms in the broiler production, 2009

	No. of holdings	No. of houses/flocks	Livestock (capacity)
Rearing period (grandparent)	2	5	50,000
Adult period (grandparent)	4	18	50,000
Rearing period (parent)	16	95	130,000
Adult period (parent)	46	152	720,000
Hatcheries	5	-	-
Broilers	237	578	-

Source: Danish Veterinary and Food Administration and Danish Agriculture and Food Council

Table A41. Number of farms in the table egg production, 2009

	No. of holdings	No. of houses/flocks	Livestock (capacity)
Rearing period (parent)	4	5	20,000
Adult period (parent)	6	6	30,000
Hatcheries	5	-	-
Pullet-rearing	90	152	1,400,000
Layers (excl. Barnyard)	211	288	3,020,000

Source: Danish Veterinary and Food Administration and Danish Agriculture and Food Council

Table A42. Distribution of import, export and production of fresh and frozen meat and the production of table eggs in Denmark, 2007-2009. Data is presented in tons

	Year	Pork	Beef	Broiler meat[a]	Turkey meat	Duck meat[b]	Table eggs[c]
Import	2007	40,201	80,287	30,390	8,423	3,845	-
	2008	83,057	81,427	32,480	8,264	4,494	-
	2009	83,265	88,818	30,321	7,000	4,251	-
Export	2007	1,263,169	61,374	105,741	1,692	454	-
	2008	1,386,849	66,690	109,725	2,345	772	-
	2009	1,321,820	78,572	108,377	1,564	534	-
Production	2007	1,447,894	134,374	168,354	34	2,956	66,800
	2008	1,602,648	149,744	157,543	49	37	67,900
	2009	1,508,640	163,068	159,723	93	0	60,600
Consumption[d]	2007	224,925	153,287	93,003	6,765	6,347	-
	2008	298,857	164,481	80,298	5,968	3,722	-
	2009	270,084	173,314	81,667	5,529	3,717	-

a) Natural-marinated chicken is included.

b) Mixed products of ducks, geese and guinea fowl are not included.

c) Consumption of table eggs is assumed to be roughly the same as the production, since import and export of table eggs is minimal.

d) Consumption = Production + import - export

Source: Statistics Denmark

Appendix F

List of Figures

List of Tables

Contributing Institutions:

Danish Zoonosis Centre
National Food Institute
Technical University of Denmark
Mørkhøj Bygade 19
DK - 2860 Søborg
Tel: +45 40 21 53 77
E-mail: vibb@food.dtu.dk
www.food.dtu.dk

Statens Serum Institut
Artillerivej 5
DK - 2300 København S
Tel: +45 3268 3268
E-mail: serum@ssi.dk
www.ssi.dk

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

The National Veterinary Institute
Technical University of Denmark
Bülowsvej 27
DK - 1790 Copenhagen V
Tel: +45 3588 6000
E-mail: vet@vet.dtu.dk
www.vet.dtu.dk

The Danish Plant Directorate
Skovbrynet 20
DK - 2800 Lyngby
Tel: +45 4526 3600
E-mail: pdir@pdir.dk
www.pdir.dk

Danish Agriculture and Food Council
Axelborg, Axeltorv 3
DK - 1609 Copenhagen V
Tel: +45 3339 4000
E-mail: info@lf.dk
www.lf.dk

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

T: 35 88 70 00
F: 35 88 70 01
www.food.dtu.dk

ISSN: 1600-3837