



SALMONELLA: FROM FARM TO FORK

No. 8, 2005

Each year, the Zoonosis Centre at the Danish Institute for Food and Veterinary Research estimates the number of human salmonella infections which may be attributable to various animal foodstuffs. The result is popularly called the "salmonella source account" and is based on comparing the number of recorded human cases caused by different types of salmonella with the distribution of the same types in domestic animals and foodstuffs. It is assumed that all human infections caused by salmonella types which almost exclusively occur in a single reservoir (i.e. one species of domestic animal or foodstuffs produced from it), derive from these infections. Infections caused by types occurring in several different reservoirs are subsequently distributed proportionally in relation to these.

Prerequisites for the method

It is a prerequisite that certain salmonella types are only found in a single reservoir. The method also requires systematic and intensive surveillance with the collection and typing of representative salmonella isolates in the whole farm-to-fork chain. In Denmark, all major foodstuff-producing domestic animals and foodstuffs are monitored for salmonella. A third important prerequisite for the Salmonella source account is that all major outbreaks are detected, as undetected outbreaks caused by salmonella types that only occur in a single reservoir may result in an overestimation of human cases from this source. Conversely, undetected outbreaks caused by types occurring in several sources will lead to an underestimation of the total number of infections.

Data foundation

Each year, more than two million samples are taken from domestic animals and foodstuffs. All salmonella isolates are submitted to the Danish Institute for Food and Veterinary Research, where they are serotyped and tested for resistance. All isolates of *S. Typhimurium* and *S. Enteritidis* are phagetyped. SSI provides information on the human infections, including information about possible relation to travel or outbreak and determination of type. All human isolates are serotyped and all isolates of *S. Typhimurium* are phagetyped and tested for resistance. About 50% of *S. Enteritidis* isolates are phagetyped.

Significance of travel anamnesis

It is essential to have data about the

Figure 1. Incidence of human salmonella infections, 1988-2003, total and by animal foodstuffs

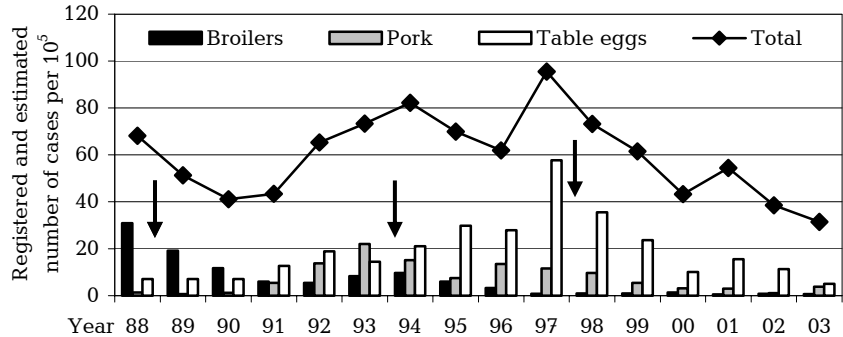
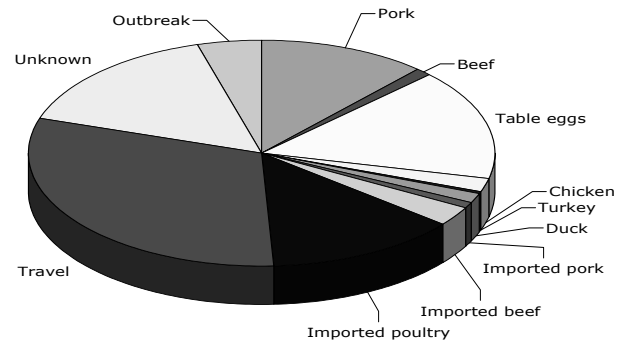


Figure 2. Human salmonella infections by source of infection, 2003



number of travel-associated cases, as these cannot be ascribed to foodstuffs consumed in Denmark. In recent years, information about travel anamnesis has undergone a significant deterioration. Due to the fact that traveling abroad gain greater significance as a "source", one of the prerequisites for preparing the infection source account may lapse.

Improvement of the method

During the last decade, the amount and quality of data have undergone a significant improvement, with the exception of information about foreign travel. The national surveillance has been gradually extended to include more sources, including imported foodstuffs. The development of an advanced mathematical model has made it possible to calculate uncertainty on the estimates. It is now possible to analyse the differences between the individual Salmonella types with respect to their ability to cause infection in humans. The latter is a great step forward, as it was formerly assumed that all Salmonella types had the same virulence.

Results

Figure 1 shows the development in human salmonella infections from

1988 to 2003 in relation to the three most significant Danish sources of infection. Arrows are used to indicate when the specific surveillance and control programmes were initiated. The estimated numbers of infections from chickens, pigs and eggs, respectively, have declined after the implementation of the different control programmes. The fact that the incidence of Salmonella in chickens, pigs and table egg layers has also declined, may be considered as an indirect validation of the model, which is independent of prevalence data. Figure 2 shows the results of the Salmonella source account for 2003. Table eggs and pork are still some of the most important Danish sources, but foreign travel and imported foodstuffs, especially poultry, are still gaining relatively greater significance due to the effect of the Danish control programmes. The surveillance programmes are revised on an ongoing basis and are described in "Annual Report on Zoonoses" (www.dfvf.dk). (Tine Hald, Danish Zoonosis Centre, Danish Institute for Food and Veterinary Research)

Individually notifiable diseases

Number of notifications received in the Department of Epidemiology, SSI (2005 figures are preliminary)

Table 1	Week 7 2005	Cum. 2005 ¹⁾	Cum. 2004 ¹⁾
AIDS	2	16	5
Anthrax	0	0	0
Botulism	0	0	0
Cholera	0	0	0
Creutzfeldt-Jakob	1	1	1
Diphtheria	0	0	0
Food-borne diseases	3	41	53
of these, infected abroad	0	8	8
Gonorrhoea	3	115	49
Haemorrhagic fever	0	0	0
Hepatitis A	6	20	17
of these, infected abroad	2	4	4
Hepatitis B (acute)	1	10	4
Hepatitis B (chronic)	0	17	30
Hepatitis C (acute)	0	1	0
Hepatitis C (chronic)	7	46	53
HIV	9	44	37
Legionella pneumonia	3	14	14
of these, infected abroad	0	2	1
Leprosy	0	0	0
Leptospirosis	2	5	1
Measles	0	0	0
Meningococcal disease	0	9	15
of these, group B	0	7	12
of these, group C	0	1	1
of these, unspec. + other	0	1	2
Mumps	0	1	0
Neuroborreliosis	0	11	42
Ornithosis	0	2	1
Pertussis (children < 2 years)	6	47	35
Plague	0	0	0
Polio	0	0	0
Purulent meningitis			
Haemophilus influenzae	0	0	0
Listeria monocytogenes	0	0	0
Streptococcus pneumoniae	1	7	17
Other aethiology	0	0	1
Unknown aethiology	0	0	3
Under registration	6	30	-
Rabies	0	0	0
Rubella (congenital)	0	0	0
Rubella (during pregnancy)	0	0	0
Shigellosis	2	18	12
of these, infected abroad	1	16	10
Syphilis	0	13	26
Tetanus	0	2	0
Tuberculosis	16	61	39
Typhoid/paratyphoid fever	0	3	3
of these, infected abroad	0	2	2
Typhus	0	0	0
VTEC/HUS	1	16	20
of these, infected abroad	1	9	4

¹⁾ Cumulative number 2005 and in corresponding period 2004

Selected laboratory diagnosed infections

Number of specimens, isolates, and/or notifications received in SSI laboratories

Table 2	Week 7 2005	Cum. 2005 ²⁾	Cum. 2004 ²⁾
Bordetella pertussis (all ages)	12	128	125
Gonococci	4	59	40
of these, females	1	8	10
of these, males	3	51	30
Listeria monocytogenes	0	6	3
Mycoplasma pneumoniae			
Resp. specimens ³⁾	41	434	28
Serum specimens ⁴⁾	39	274	77
Streptococci ⁵⁾			
Group A streptococci	4	23	25
Group C streptococci	1	4	5
Group G streptococci	6	24	9
S. pneumoniae	36	212	254
Table 3	Week 5 2005	Cum. 2005 ²⁾	Cum. 2004 ²⁾
Pathogenic int. bacteria ⁶⁾			
Campylobacter	42	237	202
S. Enteritidis	6	28	26
S. Typhimurium	8	44	32
Other zoon. salmonella	7	34	38
Yersinia enterocolitica	4	24	19

²⁾ Cumulative number 2005 and corresponding period 2004

³⁾ Resp. specimens with positive PCR

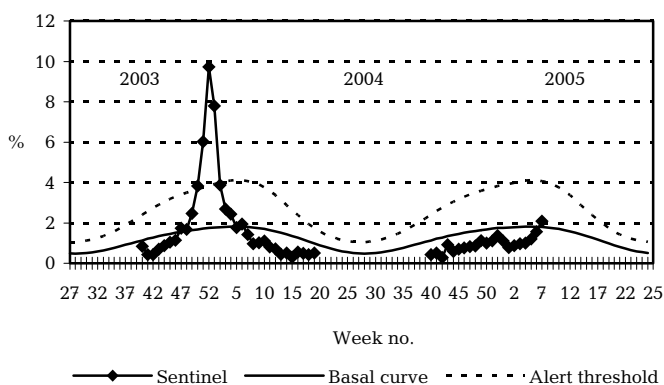
⁴⁾ Serum specimens with pos. complement fixation test, MPT

⁵⁾ Isolated in blood or spinal fluid

⁶⁾ See also www.germ.dk

Sentinel surveillance of the influenza activity

Weekly percentage of consultations, 2003/2004/2005



Sentinel: Influenza consultations (as percentage of total consultations)

Basal curve: Expected frequency of consultations under non-epidemic conditions

Alert threshold: Possible incipient epidemic