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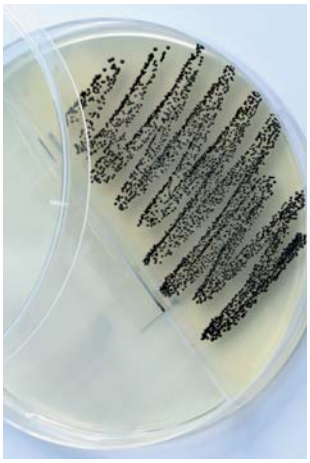
Community Summary Report

Food-borne outbreaks in the European Union in 2007

April 2009

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THE COMMUNITY SUMMARY REPORT | 2

Food-borne outbreaks in the European Union in 2007

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About EFSA

The European Food Safety Authority (EFSA), located in Parma, Italy, was established and funded by the European Community as an independent agency in 2002 following a series of food scares that caused the European public to voice concerns about food safety and the ability of regulatory authorities to protect consumers.

In close collaboration with national authorities and in open consultation with its stakeholders, EFSA provides objective scientific advice on all matters with a direct or indirect impact on food and feed safety, including animal health and welfare and plant protection. EFSA is also consulted on nutrition in relation to Community legislation.

EFSA's work falls into two areas: risk assessment and risk communication. In particular, EFSA's risk assessments provide risk managers (EU institutions with political accountability, i.e. the European Commission, the European Parliament and the Council) with a sound scientific basis for defining policy-driven legislative or regulatory measures required to ensure a high level of consumer protection with regard to food and feed safety. EFSA communicates to the public in an open and transparent way on all matters within its remit.

Collection and analysis of scientific data, identification of emerging risks and scientific support to the Commission, particularly in the case of a food crisis, are also part of EFSA's mandate, as laid down in the founding Regulation (EC) No 178/2002 of 28 January 2002.

About ECDC

The European Centre for Disease Prevention and Control (ECDC), an EU agency based in Stockholm, Sweden, was established in 2005. The objective of ECDC is to strengthen Europe's defences against infectious diseases.

According to Article 3 of the founding Regulation (EC) No 851/2004 of 21 April 2004, ECDC's mission is to identify, assess and communicate current and emerging threats to human health posed by infectious diseases. In order to achieve this mission, ECDC works in partnership with national public health bodies across Europe to strengthen and develop EU-wide disease surveillance and early warning systems. By working with experts throughout Europe, ECDC pools Europe's health knowledge, so as to develop authoritative scientific opinions about the risks posed by current and emerging infectious diseases.

About the report

Based on Article 33 in the Regulation (EC) 178/2002, EFSA's Zoonoses unit is responsible for examining data on zoonoses, antimicrobial resistance and food-borne outbreaks collected from the Member States in accordance with Directive 2003/99/EC and for preparing the Community Summary Report from the results. Regarding food-borne outbreak data from 2007, this Community Summary Report was produced in collaboration with ECDC. The Zoonoses Collaboration Centre (contracted by EFSA) in the National Food Institute, Technical University of Denmark, assisted EFSA and ECDC in this task.

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Food-borne outbreaks are infections or intoxications in humans caused by the consumption of a common contaminated foodstuff. Information from investigated food-borne outbreaks in the European Union Member States is collected based on the Directive 2003/99/EC. Together 22 MSs and two other European countries submitted information on food-borne outbreaks in 2007. A new reporting system for outbreaks was applied for the first time and the outbreaks were divided into possible food-borne outbreaks and verified food-borne outbreaks. Detailed information was only reported from verified outbreaks where the link between human cases and the food source is supported by strong evidence.

In total, 5,609 food-borne outbreaks were reported by MSs in 2007 that is a slight decrease of 2.2% compared to 2006. Together 36.1% of the reported outbreaks were classified as verified. The verified outbreaks affected 39,727 people resulting in 3,291 hospitalisations and causing 19 deaths. In addition, the two non-MSs reported 93 food-borne outbreaks, of which 38.7% were verified and 1,475 people were affected, resulting in 55 hospitalisations and causing five deaths. France and Spain reported most (73.0%) of the verified outbreaks in the European Union. There was a great variation between MSs in the numbers and proportions of verified outbreaks reported, which may reflect differences in the sensitivity and efficiency of the national systems for investigating and reporting outbreaks in place.

The causative agent was known in 74.4% of the food-borne outbreaks reported by MSs. Approximately two-thirds of the verified outbreaks were general outbreaks affecting members of more than one household, and one-third were household outbreaks. Detailed information on implicated foodstuffs (food vehicle) was reported in 68.8% of the verified outbreaks. The most common single food vehicle was eggs and egg products, responsible for 14.6% of the outbreaks. Other than private households, the most common setting of exposure to verified reported outbreaks was restaurants and cafés.

Salmonella was, as in previous years, the most commonly reported cause of food-borne outbreaks in the European Union. Twenty-two MSs reported 2,201 *Salmonella* outbreaks of which 26.8% were verified. The 590 verified *Salmonella* outbreaks affected 8,922 people, resulted in 1,773 hospitalisations and caused 10 deaths. *S.* Enteritidis was the most common serovar involved and eggs or products thereof were the most frequently implicated foodstuffs in these outbreaks.

Food-borne viruses, mainly calicivirus (including norovirus), were reported as the second most common known cause of food-borne outbreaks, and 18 MSs reported a total of 668 outbreaks of which 16.6% were verified. The 111 verified virus outbreaks affected 3,784 people and resulted in 131 hospitalisations. The majority of the outbreaks were general outbreaks and the food vehicles most frequently associated with infection were crustaceans, shellfish, molluscs and buffet meals.

Campylobacter also remained a common cause of food-borne outbreaks in the EU and 17 MSs reported 461 outbreaks where only 6.5% were verified. The 29 verified *Campylobacter* outbreaks (excluding the large waterborne outbreak) affected 244 people and resulted in 19 hospitalisations. Broiler meat and unspecified meat were reported as the most common implicated foodstuff from outbreaks caused by *Campylobacter*.

Fourteen MSs reported 65 outbreaks caused by pathogenic *E. coli*, of which 44.6% were verified. The 29 verified *E. coli* outbreaks affected 541 people and resulted in 24 hospitalisations. Bacterial toxins produced by *Bacillus* spp., *Clostridium* spp. or *Staphylococcus* spp. were reported by 18 MSs as the cause of 458 outbreaks, of which 93.2% were verified. The 427 verified outbreaks caused by bacterial toxins affected 6,277 people, resulted in 345 hospitalisations and caused four deaths. Few outbreaks caused by other bacterial agents like *Yersinia*, *Listeria*, *Shigella*, *Enterobacter* and *Citrobacter* were reported. In addition, a number of outbreaks caused by parasites were recorded and most of them were *Trichinella* outbreaks related to consumption of uninspected pig and wild boar meat.

Other causative agents like histamine (69 outbreaks) and toxins in mushrooms (43 outbreaks) were reported particularly by some MSs. The household kitchen had a contributory role in these outbreaks and half of the verified outbreaks took place in households. Eight MSs reported 17 waterborne outbreaks, which affected 10,912 people and resulted in 232 hospitalisations. Two large outbreaks in Finland affected 8,000 and 2,000 cases, respectively. The largest one involved 8,000 reported cases and 200 hospitalisations and the main causative agents reported were *Campylobacter* and *Giardia*.

Introduction | 1

The collection of data on investigated food-borne outbreaks under the Zoonoses Directive 2003/99/EC[1] aims to provide information that can be used by the European Commission (EC), other Community institutions and agencies and the European Union (EU) Member States (MSs) in their policies of improving food safety. In particular, data on food-borne outbreaks contribute to the knowledge of the food vehicles causing human infections.

A 'food-borne outbreak' is defined by the Directive 2003/99/EC, as *"an incidence, observed under given circumstances, of two or more human cases of the same disease and/or infection, or a situation in which the observed number of human cases exceeds the expected number and where the cases are linked, or are probably linked, to the same food source"*. Whereas, food is defined in Regulation (EC) No 178/2002[2] to be *"any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans"*. This definition includes also drinking water and covers single food items as well as composite meals.

The framework of reporting

The Community system for the collection of information on zoonoses is based on Directive 2003/99/EC which obligates EU MSs to collect relevant and, where applicable, comparable data of zoonoses, zoonotic agents, antimicrobial resistance and food-borne outbreaks. MSs shall assess trends and sources of these agents and outbreaks in their territory, and transmit to the EC a report covering the data collected annually. The European Food Safety Authority (EFSA) is assigned the tasks of examining the data collected and publishing the Community Summary Report.

The Decision 2119/98/EC[3] on setting up a network for the epidemiological surveillance and control of communicable diseases in the Community, as complemented by Decision 2000/96/EC[4] and as amended by Decision 2003/542/EC[5] on the diseases to be progressively covered by the network, established the basis for data collection on human communicable diseases from MSs. The Decisions foresee that data from the networks shall be used in the Community Summary Report. Networks on communicable diseases are coordinated by the European Centre for Disease Prevention and Control (ECDC).

For the data from 2007, information on zoonoses, zoonotic agents, antimicrobial resistance and food-borne outbreaks is published in three Community Summary Reports. The first report covered information on zoonoses and zoonotic agents and the current report includes information on food-borne outbreaks. The data on antimicrobial resistance from 2007 will be published later in a separate report.

This Community Summary Report on Food-borne Outbreaks 2007 was prepared in collaboration between EFSA and ECDC and assisted by EFSA's Zoonoses Collaboration Centre (ZCC), the National Food Institute, Technical University of Denmark. A preliminary version of the report was sent to the MSs and other reporting countries and the EU Commission for consultation.

1. Directive 2003/99/EC of the European Parliament and of the Council of 17 November 2003 on the monitoring of zoonoses and zoonotic agents, amending Council Decision 90/424/EEC and repealing Council Directive 92/117/EEC, OJ L 325, 12.12.2003 p. 31
2. Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety, OJ L 31, 1.2.2002, p.1
3. Decision N° 2119/98/EC of the European Parliament and of the Council of 24 September 1998 setting up a network for the epidemiological surveillance and control of communicable diseases in the Community , OJ L 268, 3.10.1998, p.1
4. 2000/96/EC: Commission Decision of 22 December 1999 on the communicable diseases to be progressively covered by the Community network under Decision No 2119/98/EC of the European Parliament and of the Council, OJ L 28, 3.2.2000, p.50
5. 2003/542/EC: Commission Decision of 17 July 2003 amending Decision 2000/96/EC as regards the operation of dedicated surveillance networks. OJ L 185, 24.7.2003, p. 55

New reporting system for food-borne outbreaks

Data on investigated food-borne outbreaks currently collected through the Community reporting system include information to be reported both on a mandatory and on an optional basis. The minimum information required on the results of investigations of food-borne outbreaks is laid down in Annex IV (E) of Directive 2003/99/EC.

In order to develop further the reporting of outbreaks and to investigate the reporting systems in place in MSs, EFSA and ECDC, with the assistance of its food-borne outbreak contractor (the Bundesinstitut für Risikobewertung, BfR) conducted a questionnaire survey in 2006[6] and prepared a proposal for an improved reporting system. Based on this proposal, the Task Force on Zoonoses Data Collection agreed on harmonised reporting guidelines for food-borne outbreaks[7] on 8 November 2007. These guidelines were used by MSs for the first time when reporting data for 2007.

The objective of the new reporting system is to collect data both on possible and verified outbreaks. Verified outbreaks are considered to be ones where evidence is sufficiently strong to support the link between human cases and a food vehicle. Therefore, detailed information is only collected from verified food-borne outbreaks.

Possible food-borne outbreaks are defined as outbreaks where there is information linking the human cases to a possible common food vehicle. However, there is no further evidence to support this link.

In verified food-borne outbreaks the link between human cases and a food vehicle is supported by laboratory detection of the causative agent in the implicated foodstuff and/or by analytical epidemiological evidence providing a statistically significant association between the food vehicle and human cases.

The variables to be reported for verified outbreaks are chosen according to the relevance of the information at Community level and whether meaningful analyses can be carried out at a supra-national level.

The reporting system on food-borne outbreaks covers outbreaks caused by biological agents, including toxins and other substances produced by bacteria or other biological agents (e.g. Staphylococcal enterotoxins and histamine), whereas outbreaks caused by chemical agents are excluded. Since drinking water is defined as food, it is covered by the reporting as well.

Data received for 2007

In 2007, data on food-borne outbreaks were submitted by 22 MSs. No reports were received from Bulgaria, Cyprus, Italy, Luxembourg and Portugal. In addition, two non-MSs, Norway and Switzerland, provided information. Countries submitted data to EFSA either by using a web-based zoonoses reporting system or by sending the information in a pre-defined XML format.

The draft Community Summary Report on outbreaks was sent to MSs for consultation on 18 February 2009 and comments were collected by 6 March 2009. The utmost efforts were made to incorporate comments and data amendments within the available time frame. The final report was issued by EFSA and ECDC on 30 April 2009.

The national procedures for the investigation and reporting of food-borne outbreaks covered in this report are not harmonised between MSs, and findings presented in this report must, therefore, be interpreted with care. The data presented may not accurately represent the national situation and results are generally not directly comparable between MSs and sometimes not even between different years in some countries.

6. Report on food-borne outbreak reporting systems in place in the Member States of the European Union and on needs for information on food-borne outbreaks in the European Community – results of a questionnaire survey on the EFSA website, *The EFSA Journal* (2007) 577, 1-37
7. Report of the Task Force on Zoonoses Data Collection on harmonising the reporting of food-borne outbreaks through the Community reporting system in accordance with Directive 2003/99/EC, *The EFSA Journal* (2007) 123, 1-16

Summary | 2

2.1 | Main conclusions

Food-borne outbreaks are infections or intoxications in humans caused by the consumption of a common contaminated food. Information from investigated food-borne outbreaks in MSs is collected based on the Zoonoses Directive 2003/99/EC. This information contributes to the estimation of the disease burden of food-borne diseases in the EU and significantly increases knowledge of the food sources of these diseases.

In total, 22 MSs and two non-MSs submitted information on food-borne outbreaks in their country in 2007. A new reporting system was applied for the first time. In this system data from both possible and verified outbreaks may be reported. Detailed information can only be reported from verified outbreaks including evidence supporting the link between human cases of disease and the food source. From the possible food-borne outbreaks only information on the total number of outbreaks per causative agent is reported. The new reporting system will improve the quality of the data on food-borne outbreaks at Community level, but further guidance is still needed to guide MSs in harmonised reporting.

Food-borne outbreaks reported

In 2007, a total of 5,609 food-borne outbreaks were reported by EU MSs of which 36.1% were verified. The verified outbreaks involved 39,727 people, resulting in 3,291 hospitalisations and causing 19 deaths. In addition, two non-MSs reported 93 food-borne outbreaks, of which 38.7% were verified and where 1,475 people were affected, hospitalising 55 and causing five deaths. France and Spain reported 73.0% of verified outbreaks in the EU; however 26.7% of all human cases within the EU were due to two large waterborne outbreaks in Finland. There was great variation among MSs in the numbers and proportions of verified outbreaks reported, which may reflect differences in the sensitivity and efficiency of the national systems in place for the investigation and reporting of outbreaks. Since data on the verified outbreaks were dominated by some MSs, these results may not be representative for the whole Community.

The average reporting rate in the EU per population of 100,000 was 1.13 outbreaks for all outbreaks and 0.51 for verified outbreaks. The causative agent was known in three out of the four food-borne outbreaks reported by MSs. In total, 66.6% of the verified outbreaks were general outbreaks affecting members of more than one household, 32.0% were household outbreaks and only 1.4% were notified as an unknown type of outbreak.

According to the definition of verified outbreaks, either isolates from the implicated food vehicle or analytical epidemiological evidence is required and these evidences were specified for 22.6% and 42.5% of the verified outbreaks, respectively.

Detailed information on implicated foodstuffs (food vehicle) was reported in 68.8% of the verified outbreaks. The most common single food vehicle in the outbreaks was eggs and egg products, responsible for 14.6% of the outbreaks. Besides private households (37.0%), the most common setting of exposure for verified reported outbreaks was restaurants and cafés (28.6%). The origin of the food vehicle (imported or domestic products) and the place of origin of the problem were mainly reported as unknown.

2.2 | Agent specific summaries

Salmonella outbreaks

Salmonella was, as in previous years, the most commonly reported cause of food-borne outbreaks in the EU. The 22 MSs reported 2,201 *Salmonella* outbreaks of which 26.8% were verified. The 590 verified *Salmonella* outbreaks affected 8,922 people, hospitalised 1,773 cases and caused 10 reported deaths. *S.* Enteritidis was the most common serovar involved and eggs or products thereof were the most frequently implicated foodstuffs in these outbreaks.

Campylobacter outbreaks

Campylobacter remained a common cause of food-borne outbreaks in the EU and 17 MSs reported 461 outbreaks where only 6.5% were verified. The 29 verified *Campylobacter* outbreaks (excluding a large waterborne outbreak) affected 244 people and hospitalised 19 cases. Broiler meat and unspecified meat were reported as the most commonly implicated foodstuff.

Escherichia coli outbreaks

Fourteen MSs reported 65 outbreaks caused by pathogenic *E. coli*, out of which 44.6% were verified. The 29 verified outbreaks affected 541 people and hospitalised 24 cases. The implicated food vehicles were notified in 83.3% of the outbreaks, but no distinct food vehicles could be singled out.

Outbreaks caused by other bacterial agents

Few outbreaks caused by other bacterial agents like *Yersinia*, *Listeria*, *Shigella*, *Enterobacter* and *Citrobacter* were reported. Only Poland and Spain reported a verified *Yersinia* outbreak. No verified *Listeria* outbreaks were reported in 2007 by the MSs. However, one verified *Listeria* outbreak was recorded in a non-MS.

Outbreaks caused by bacterial toxins

Bacterial toxins produced by *Bacillus* spp., *Clostridium* spp. or *Staphylococcus* spp. were reported by 18 MSs as the cause of 458 outbreaks, of which 93.2% were verified. The 427 verified outbreaks caused by bacterial toxins affected 6,277 people, hospitalised 345 cases and caused four deaths.

Virus outbreaks

Food-borne viruses, mainly calicivirus (including norovirus), were reported as the second most common known cause of food-borne outbreaks in the EU, and 18 MSs reported together 668 outbreaks of which 16.6% were verified. The 111 verified virus outbreaks affected 3,784 people and hospitalised 131 cases. The majority of the outbreaks were general outbreaks and the food vehicles most frequently associated with infection were crustaceans, shellfish, molluscs and products thereof as well as buffet meals.

Outbreaks caused by parasites

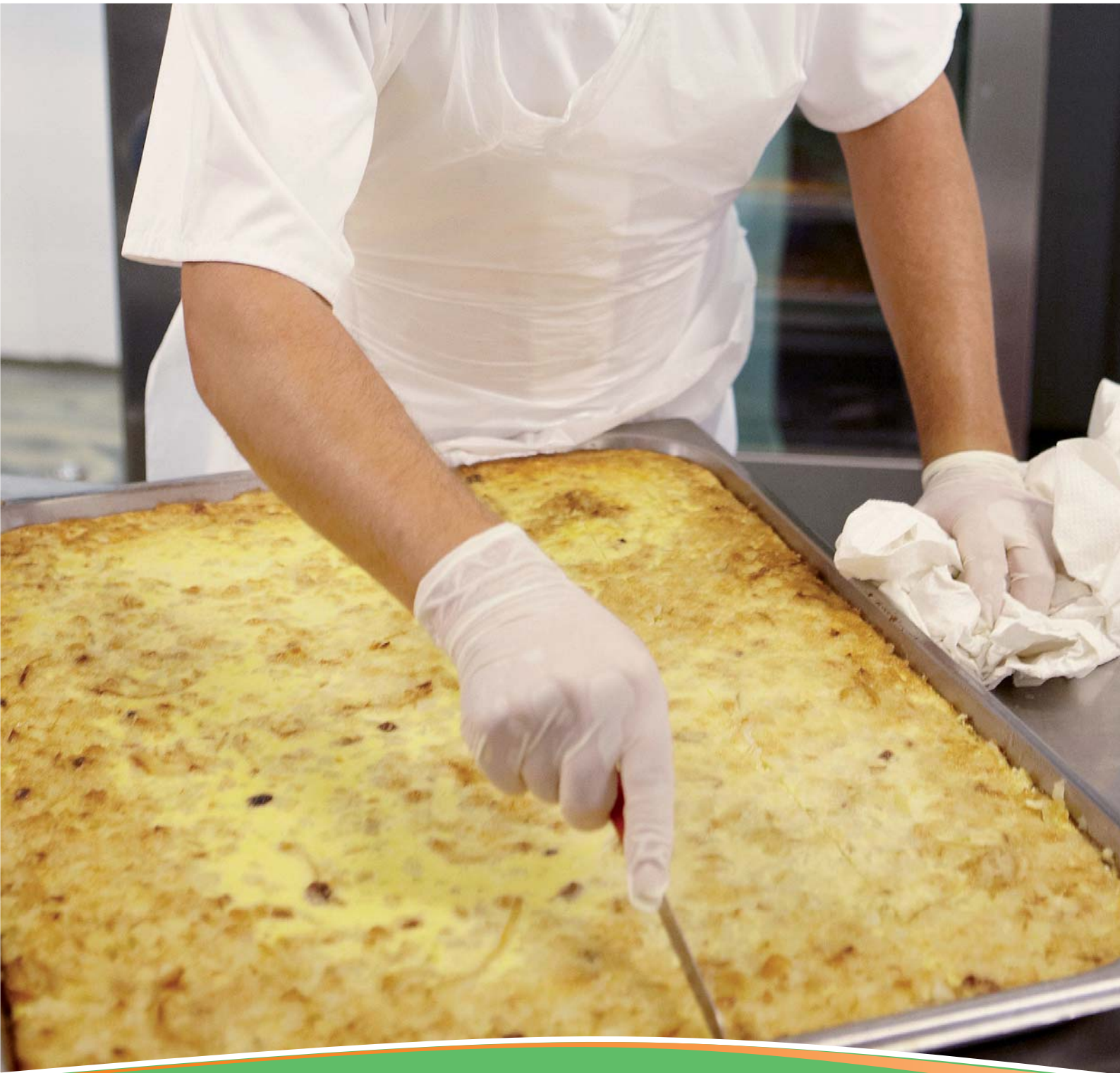
Together 57 food-borne outbreaks caused by parasites were reported by MSs, and 35 of them were verified. The majority of the outbreaks were caused by *Trichinella* outbreaks and these outbreaks were often linked to consumption of pig and wild boar meat.

Outbreaks caused by other causative agents

Other causative agents such as histamine (in 69 outbreaks) and toxins in mushrooms (in 43 outbreaks) were reported particularly by some MSs. The private kitchen plays an important role in these outbreaks and half the verified outbreaks were in households.

Waterborne outbreaks

Eight MSs reported 17 waterborne outbreaks, which infected 10,912 people and hospitalised 232. Two large outbreaks in Finland affected about 8,000 and 2,000 cases, respectively. Several causative agents were isolated from the waterborne outbreaks.



General overview | 3.1

3.1 | General overview

The reporting of food-borne outbreaks has been mandatory for the EU MSs since 2005. In 2007, new harmonised specifications on the reporting of these outbreaks at Community level have been applied[8]. However, the food-borne outbreak investigation and reporting systems at national level are not harmonised within the EU. Therefore, differences in the numbers of the reported outbreaks, the types of outbreaks and causative agents do not necessarily reflect different levels of food safety between MSs. It is more likely that the high number of reported outbreaks indicates the effectiveness and sensitivity of the national system for investigating and identification of the outbreaks.

All food-borne outbreaks reported by MSs and non-MSs in 2007 are incorporated in this report. MSs submitted information on the total number of reported food-borne outbreaks caused by different causative agents, including food-borne outbreaks where the causative agent was unknown. In verified outbreaks, laboratory results or analytical epidemiological evidence disclosed a link between human cases and implicated foodstuffs. In verified outbreaks MSs have reported detailed information covering type of outbreak, number of human cases, hospitalisations and deaths, implicated foodstuffs, setting, contributing factors and type of evidence. For the outbreaks where this link cannot be demonstrated (possible outbreaks), only the causative agent was reported. Due to the new reporting system applied in 2007, fewer outbreaks are described in detail compared to previous years, where detailed information was also provided for some of the possible outbreaks reported. However, the information submitted on verified outbreaks is supposed to be of higher quality than previously.

In 2007, 22 MSs and two non-MSs provided data on food-borne outbreaks. An overview of countries reporting data on food-borne outbreaks is provided in Table GE1. No outbreak data were received from Bulgaria, Cyprus, Italy, Luxembourg and Portugal.

Table GE1. | ***Overview of countries reporting data on food-borne outbreaks, 2007***

Outbreak	Total number of MSs reporting	Countries
Salmonella	22	**All MSs** except BG, CY, IT, LU, PT **Non-MSs:** NO, CH
Campylobacter	17	**MSs:** AT, BE, CZ, DK, EE, FI, FR, DE, HU, IE, LT, MT, NL, PL, ES, SE, UK **Non-MSs:** NO, CH
Pathogenic *E. coli*	14	**MSs:** AT, BE, DK, FR, DE, GR, IE, LT, MT, PL, SI, ES, SE, UK **Non-MS:** NO
Yersinia	7	**MSs:** BE, EE, DE, LV, LT, PL, ES **Non-MS:** NO
Other bacterial agents	8	**MSs:** AT, DK, FI, FR, DE, LV, SK, ES **Non-MS:** NO
Bacterial toxins	18	**MSs:** AT, BE, CZ, DK, FI, FR, DE, HU, LV, LT, MT, NL, PL, RO, SK, ES, SE, UK **Non-MSs:** NO, CH
Viruses	18	**MSs:** AT, BE, CZ, DK, FI, FR, DE, GR, HU, LV, LT, MT, NL, PL, SK, ES, SE, UK **Non-MS:** NO
Parasites	8	**MSs:** DE, IE, LV, LT, PL, RO, SK, ES **Non-MS:** NO
Other causative agents	11	**MSs:** AT, DK, FI, FR, GR, HU, LT, PL, ES, SE, UK **Non-MS:** CH

In 2007, a total of 5,609 food-borne outbreaks were reported by the 22 MSs, including both possible and verified outbreaks (Table GE2). This represented a slight decrease of 2.2% compared to 2006, where the MSs reported 5,736 outbreaks. In the three years since the reporting of food-borne outbreaks became mandatory in 2005, 19 MSs[9] and one non-MS (NO) have provided outbreak data continuously. In total, the average number of outbreaks reported in 2007 per EU population of 100,000 was 1.13 outbreaks (Table GE2). Malta had the highest reporting rate of 13.98 per population of 100,000 followed by Latvia (10.21) and Austria (5.28).

8. Report of the Task Force on Zoonoses Data Collection on harmonising the reporting of food-borne outbreaks through the Community reporting system in accordance with Directive 2003/99/EC, *The EFSA Journal* (2007) 123, 1-16
9. AT, BE, CZ, DK, EE, FI, FR, DE, GR, IE, LV, LT, NL, PL, SK, SI, ES, SE and UK

In 2007, a few MSs reported the majority of outbreaks; these were primarily MSs with relatively large human populations. Germany and France reported 25.0% and 17.5% of all outbreaks, respectively, within the EU. In total within the EU, 36.1% of all reported outbreaks were verified. However, France, Poland and Spain reported 80.7% of these outbreaks.

The two non-MSs, Norway and Switzerland, reported 93 outbreaks in 2007, of which 38.7% were verified.

Within the EU, the causative agent (aetiology) was known in 74.4% of verified outbreaks, ranging from 17.7% to 100% among MSs. Ten MSs[10] reported the causative agent in more than 75% of outbreaks (Table GE2).

Table GE2. | ***Reported food-borne outbreaks, 2005-2007***

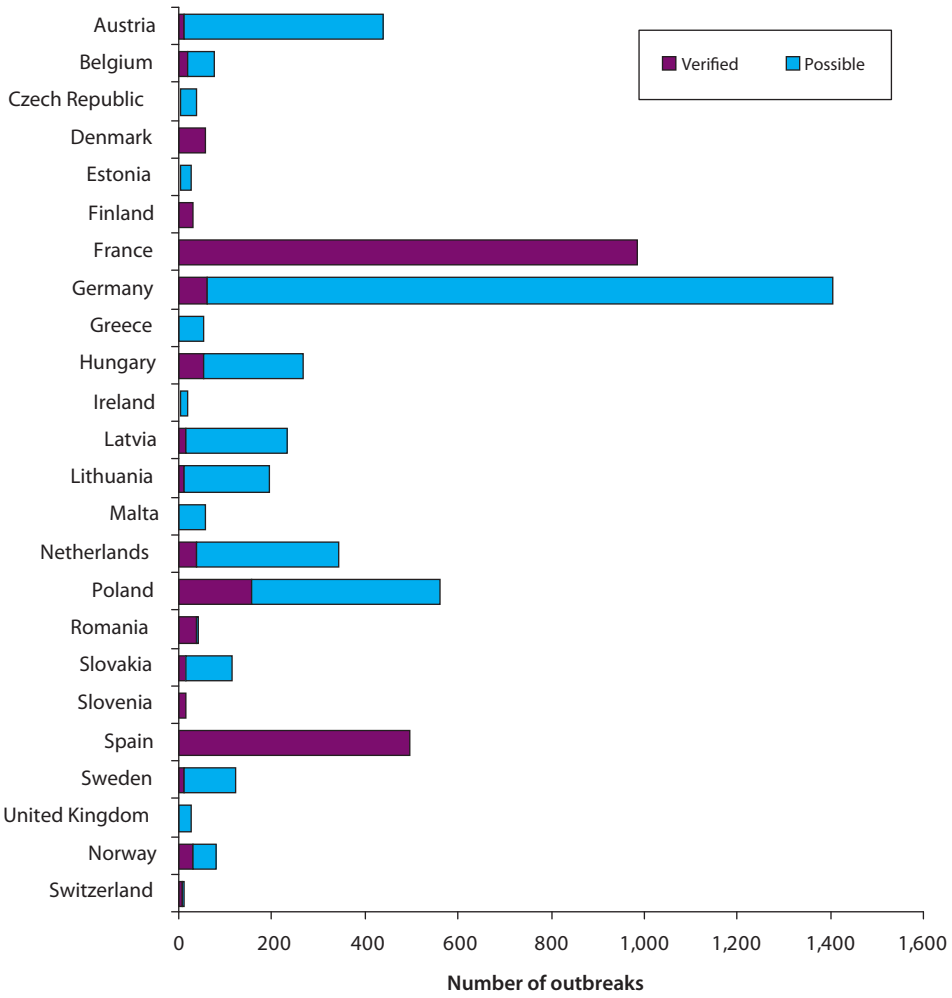
Country	2007						2006	2005
	N	% of EU total	Reporting rate per 100,000	Possible outbreaks (N)	Verified outbreaks (N)	% with aetiology[1]	N	N
Austria	438	7.8	5.28	427	11	99.8	609	615
Belgium	75	1.3	0.71	54	21	46.7	116	104
Czech Republic	37	0.7	0.36	33	4	86.5	65	79
Denmark	57	1.0	1.05	0	57	100	53	98
Estonia	28	0.5	2.09	26	2	100	27	20
Finland	32	0.6	0.61	0	32	71.9	46	58
France	984	17.5	1.55	0	984	60.7	904	0
Germany	1,405	25.0	1.71	1,343	62	100	1,370	1,262
Greece	55	1.0	0.49	55	0	72.7	58	44
Hungary	269	4.8	2.67	217	52	97.4	174	-
Ireland	20	0.4	0.46	15	5	70.0	27	0
Italy[2]	-	-	-	-	-	-	156	96
Latvia	233	4.2	10.21	218	15	75.1	309	85
Lithuania	196	3.5	5.79	186	10	68.4	103	38
Luxembourg	-	-	-	-	-	-	0	1
Malta	57	1.0	13.98	57	0	31.6	-	21
Netherlands	345	6.2	2.11	308	37	17.7	49	44
Poland	562	10.0	1.47	407	155	66.9	561	492
Portugal	-	-	-	-	-	-	13	3
Romania	42	0.7	0.19	5	37	88.1	26	-
Slovakia	114	2.0	2.11	97	17	74.6	455	745
Slovenia	17	0.3	0.85	0	17	94.1	61	50
Spain	495	8.8	1.11	0	495	56.0	351	460
Sweden	123	2.2	1.35	111	12	37.4	137	139
United Kingdom	25	0.4	0.04	25	0	84.0	66	68
EU Total	**5,609**	**100**	**1.13**	**3,584**	**2,025**	**74.4**	**5,736**	**4,522**
Norway	82		1.75	53	29	62.2	66	43
Switzerland	11		0.15	4	7	63.6	6	-

1. Percent of outbreaks where the causative agent has been identified and reported
2. Only general outbreaks reported

10. AT, CZ, DK, EE, DE, HU, LV, RO, SI and UK

The extent to which MSs are able to classify outbreaks as verified is highly dependent on the MS specific outbreak investigation and reporting system, and the type of information that is available centrally in the MS. This is reflected in the large variation in the proportion of verified outbreaks reported by MSs (Figure GE1). Fourteen MSs[11] and two non-MSs (Norway and Switzerland) reported both verified and possible outbreaks; whereas Denmark, Finland, France, Slovenia and Spain only reported verified outbreaks. In contrast, Greece, Malta and the United Kingdom only reported possible outbreaks and therefore provided no detailed information on cases, implicated foodstuffs, settings or contributing factors to this report.

Figure GE1. | ***Number of possible and verified food-borne outbreaks in MSs and non-MSs, 2007***



Verified outbreaks reported by MSs involved 39,727 human cases. Of these, 8.3% were admitted to hospital and 19 cases died (0.05%). In the non-MSs, Norway and Switzerland, verified outbreaks affected 1,475 cases with 55 hospitalisations and five deaths (Table GE3). The total number of reported deaths caused by food-borne outbreaks has decreased since 2006, where 50 deaths were reported in the EU. A larger proportion of this decrease was due to a severe outbreak in the Czech Republic in 2006 causing 16 case fatalities. However, this data is not directly completely comparable due to the new reporting system from 2007 where detailed information is only provided from verified outbreaks. In 2006 and 2005, information on case fatalities was also included in reports from possible outbreaks.

11. AT, BE, CZ, EE, DE, HU, IE, LV, LT, NL, PL, RO, SK and SE

Table GE3. | ***Verified food-borne outbreaks, 2007***

Country	Outbreaks			Human cases				
	N	% of EU total	Reporting rate per 100,000	Cases	Cases/ outbreak	Hospitali-sations	Hospitalisations/ outbreak	Deaths
Austria	11	0.5	0.13	321	29.2	20	1.8	0
Belgium	21	1.0	0.20	390	18.6	17	0.8	0
Czech Republic	4	0.2	0.51	128	32.0	16	4.0	0
Denmark	57	2.8	1.05	1,486	26.1	10	0.2	0
Estonia	2	0.1	0.15	18	9.0	4	2.0	1
Finland[1]	32	1.6	0.61	10,623	332.0	201	6.3	0
France	984	48.6	1.55	11,283	11.5	748	0.8	6
Germany	62	3.1	0.08	1,716	27.7	419	6.8	1
Hungary	52	2.6	0.52	765	14.7	215	4.1	1
Ireland	5	0.2	0.12	259	51.8	19	3.8	0
Latvia	15	0.7	0.66	72	4.8	48	3.2	2
Lithuania	10	0.5	0.30	164	16.4	50	5.0	0
Netherlands	37	1.8	0.23	788	21.3	104	2.8	0
Poland	155	7.7	0.41	1,953	12.6	582	3.8	0
Romania	37	1.8	0.35	480	13.0	334	9.0	0
Slovakia	17	0.8	0.32	605	35.6	70	4.1	0
Slovenia	17	0.8	0.85	779	45.8	67	3.9	5
Spain	495	24.4	1.11	6,705	13.5	362	0.7	3
Sweden	12	0.6	0.13	1,192	99.3	5	0.4	0
EU Total	**2,025**	**100**	**0.51**	**39,727**	**19.6**	**3,291**	**1.6**	**19**
Norway	29		0.62	1,382	47.7	37	1.3	5
Switzerland	7		0.09	93	13.3	18	2.6	0

1. Includes two large waterborne outbreaks where the number of cases (total 10,000) is only an estimate

For verified outbreaks the reporting rate was 0.51 outbreaks per EU population of 100,000, France had the highest reporting rate of 1.55, which is probably an indication of their sensitive reporting system that is able to identify and investigate thoroughly outbreaks (Table GE3). France also reported the highest number of cases, 28.4% of all cases, where 6.6% of the cases were hospitalised and 0.05% of the cases died. Though Finland only reported 0.61 verified outbreaks per population of 100,000, 26.7% of all reported cases within the EU were from Finland, caused by two large waterborne outbreaks in 2007 (respectively about 8,000 and 2,000 cases). Spain reported 24.4% of all verified outbreaks within the EU and was responsible for 16.9% of all cases; 5.4% were hospitalised and 0.04% of the cases died. Romania and Latvia had the highest proportion of hospitalised cases (69.6% and 66.7% respectively) (Table GE3).

The number of cases/outbreaks could also be a good indicator of the quality of monitoring over the years as better detection and response to outbreaks should, in the end, lead to a smaller number/outbreak for the respective pathogen. However, sometimes better investigation may also be able to relate smaller outbreaks to a larger single one, thus decreasing the overall number of outbreaks. In 2007, MSs reported on average 19.6 cases per outbreak, varying from 4.8 to 332 cases, and on average 1.6 hospitalisations per outbreak.

The type of outbreak is defined as, either household outbreaks affecting only members of one single household or as general outbreaks affecting members of more than one household. Nineteen MSs[12] provided information on type of outbreak. Of the 2,025 verified outbreaks 66.6% were general outbreaks, 32.0% were household outbreaks and 1.4% were unknown. Information on type of outbreak was only provided for verified outbreaks and therefore not comparable with 2006, where 18 MSs and two non-MSs in total reported 3,074 general outbreaks and 2,733 household outbreaks. It should also be kept in mind that the reporting and investigation systems in some MSs do not cover household outbreaks at all.

12. AT, BE, CZ, DK, EE, FI, FR, DE, HU, IE, LV, LT, NL, PL, RO, SK, SI, ES and SE

Types of evidence supporting verified outbreaks reported are summarised in Table GE4. More than one type of evidence can be notified for one outbreak. The causative agent was detected from the implicated foodstuffs in 22.6% of outbreaks and from the human cases in 27.4% of outbreaks. The causative agent was laboratory characterised both from the implicated foodstuff and human cases in 2.2% of the outbreaks. Analytical epidemiological evidence supported the link between human cases and food in 42.5% of the verified outbreaks. France reported analytical epidemiological evidence in 75.8% of their verified outbreaks. Romania detected the causative agent in the implicated foodstuff in 75.7% of verified outbreaks. Whereas, Spain did not specify the type of evidence in 99.6% of outbreaks. In total, 19 MSs[13] detected the causative agent in the implicated foodstuffs and 14 MSs[14] detected the causative agent in both humans and implicated foodstuffs. Thirteen MSs[15] have reported analytical epidemiological outbreak investigations that verified the link between human cases and implicated foodstuffs.

Table GE4. | ***Evidence in verified outbreaks, 2007***

Country	N	Causative agent detected in:		Laboratory characterisation of isolates[1]	Analytical epidemiological evidence	Unknown
		Implicated foodstuff	Human cases			
Austria	11	9 [2]	10	7	3	0
Belgium	21	20	6	0	0	0
Czech Republic	4	3	0	0	0	1
Denmark	57	14	27	1	2	20
Estonia	2	2	2	0	2	0
Finland	32	17	22	4	15	1
France	984	126	163	0	746	0
Germany	62	60	59	3	4	0
Hungary	52	36	40	9	3	1
Ireland	5	2	4	0	2	0
Latvia	15	2	13	0	0	0
Lithuania	10	3	0	0	7	0
Netherlands	37	28	12	2	15	0
Poland	155	77	144	0	57	3
Romania	37	28	8	0	0	1
Slovakia	17	17	17	17	0	0
Slovenia	17	5	16	2	1	0
Spain	495	2	0	0	0	493
Sweden	12	6	11	0	4	0
EU Total	**2,025**	**457**	**554**	**45**	**861**	**520**
Norway	29	11	20	2	3	0
Switzerland	7	5	5	1	2	0

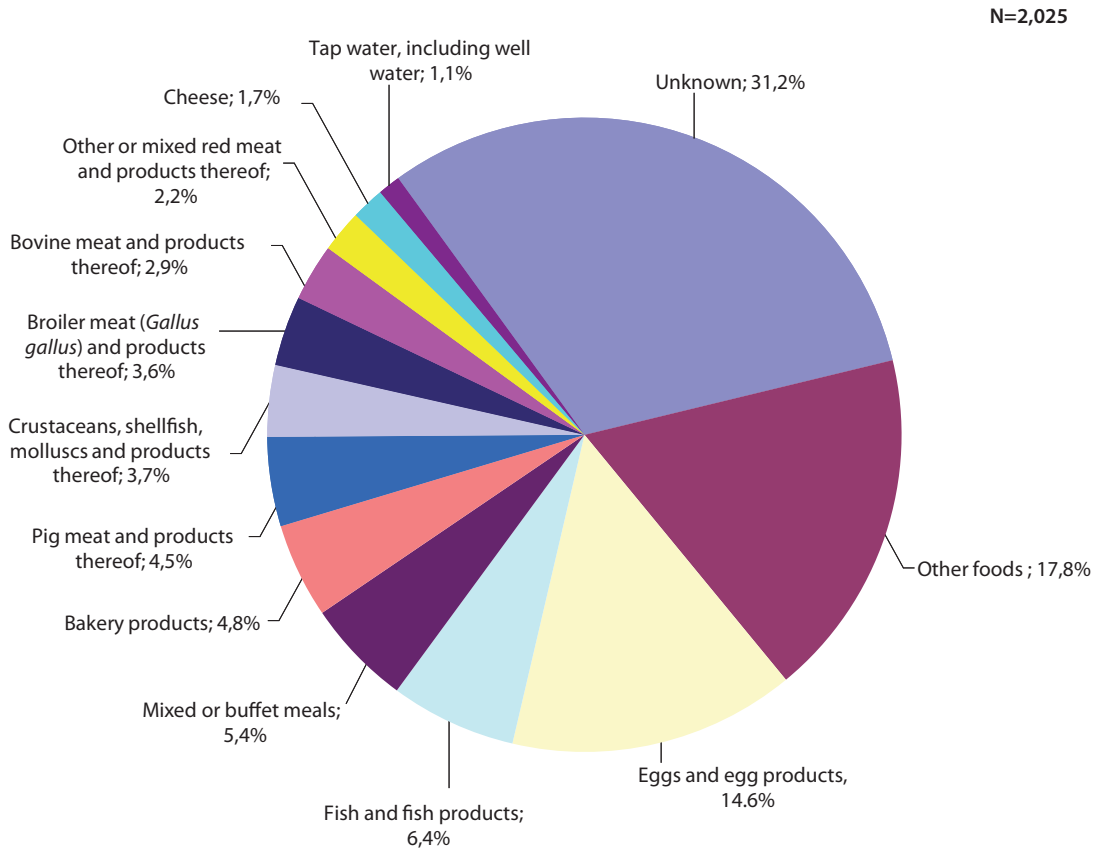
Note: countries can report more than one type of evidence per outbreak

1. Causative agent detected in both human cases and implicated foodstuffs is further characterised to confirm that the isolates from human cases and food are identical
2. Laboratory detection in implicated flocks of animals (e.g. laying hens) in four outbreaks

13. AT, BE, CZ, DK, EE, FI, FR, DE, HU, IE, LV, LT, NL, PL, RO, SK, SI, ES and SE
14. AT, BE, DK, EE, FI, FR, DE, HU, IE, NL, PL, SK, SI and SE
15. AT, DK, EE, FI, FR, DE, HU, IE, LT, NL, PL, SI and SE

In 68.8% of the 2,025 verified outbreaks, detailed information on implicated foodstuffs was provided. The most common single foodstuff category reported was eggs and egg products, responsible for 14.6% of the outbreaks, while meat (pig, broiler and bovine meat, and other meat or mixed red meat and products thereof) was reported as the implicated foodstuff in 13.2% of the outbreaks. Fish and fish products, mixed meals or buffet meals, and bakery products were the source in 6.4%, 5.4% and 4.8% of the verified outbreaks, respectively (Figure GE2). In total, 73.0% of verified outbreaks were reported by France and Spain, thus the relative importance of the implicated foodstuffs at EU level is highly dependent on the distribution of implicated foodstuffs in these two MSs. In Spain, 32.7% (162) of verified outbreaks were caused by eggs and egg products. In France, the most commonly reported food category was 'other foods', involved in 14.6% (144) of outbreaks; the most common single foodstuff category was eggs and egg products, reported for 9.2% (91) of outbreaks.

Figure GE2. | ***Distribution of implicated foodstuffs in verified outbreaks, 2007***



Note: includes data from 2,025 outbreaks: AT (11), BE (21), CZ (4), DK (57), EE (2), FI (32), FR (984), DE (62), HU (52), IE (5), LV (15), LT (10), NL (37), PL (155), RO (37), SK (17), SI (17), ES (495) and SE (12)

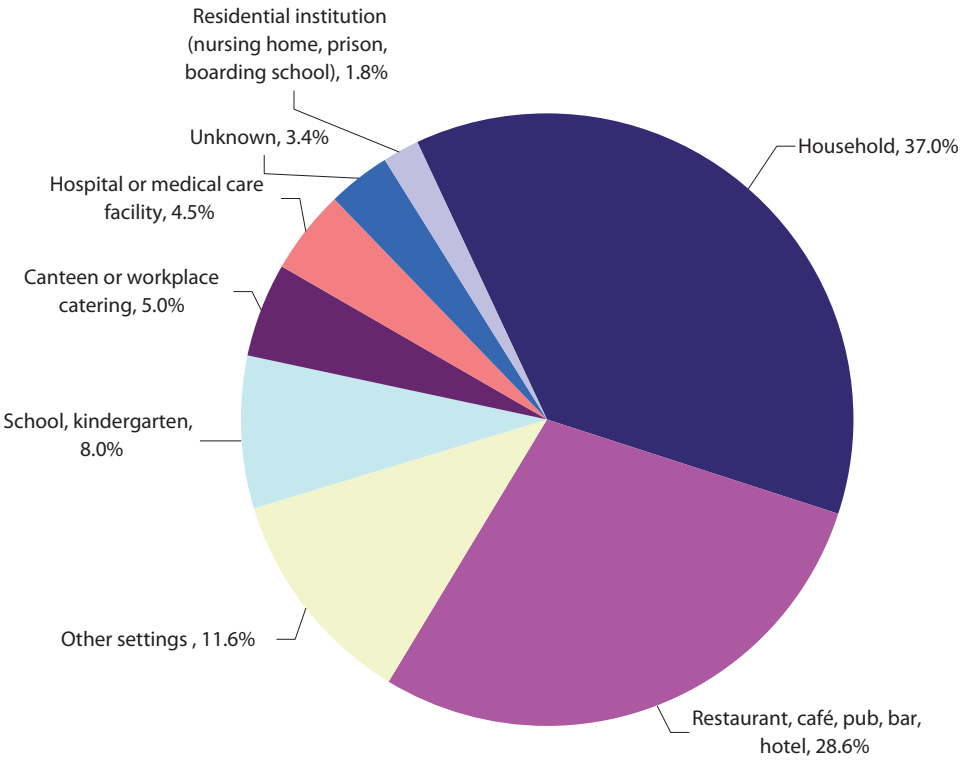
Other foods include: cereal products including rice and seeds/pulses/nuts/almonds (19), dairy products other than cheeses (18), vegetables and juices and other products thereof (16), other or unspecified poultry meat and products thereof (12), sweets and chocolate (12), milk (10), drinks, including bottled water (7), turkey meat and products thereof (6), herbs and spices (5), sheep meat and products thereof (5), canned food products (2), fruit, berries and juices and other products thereof (2) and other foods (247)

The origin of the implicated foodstuff was unknown in 83.6% of reported verified outbreaks. Domestically produced foodstuffs were reported as the source in 14.6% of verified outbreaks; intra-community traded foodstuffs and foodstuffs imported from outside the EU were reported as the source in 0.7% and 0.5% of outbreaks, respectively.

The setting of the outbreak was provided in 96.6% of verified outbreaks (Figure GE3). Households were reported as the setting in 37.0% of outbreaks where this information was provided. Apart from private households, the most common setting in verified outbreaks was restaurants/cafés etc. (28.6%) as well as schools and kindergarten (8.0%).

Figure GE3. | ***Distribution of settings in verified outbreaks, 2007***

N=2,025



Note: includes data from 2,025 outbreaks: AT (11), BE (21), CZ (4), DK (57), EE (2), FI (32), FR (984), DE (62), HU (52), IE (5), LV (15), LT (10), NL (37), PL (155), RO (37), SK (17), SI (17), ES (495) and SE (12)

Other settings include: camp, picnic (18), take-away or fast-food outlet (15), temporary mass catering (fairs, festivals) (6), mobile retailer/ market/street vendor (2), other settings (194)

The place where the contamination or improper handling of the implicated foodstuffs occurred (other than setting) was only provided in 9.7% of the verified outbreaks. The categories 'households' and 'catering services, restaurants' were the most commonly reported place of origin of the problem (4.4% and 3.0% respectively).

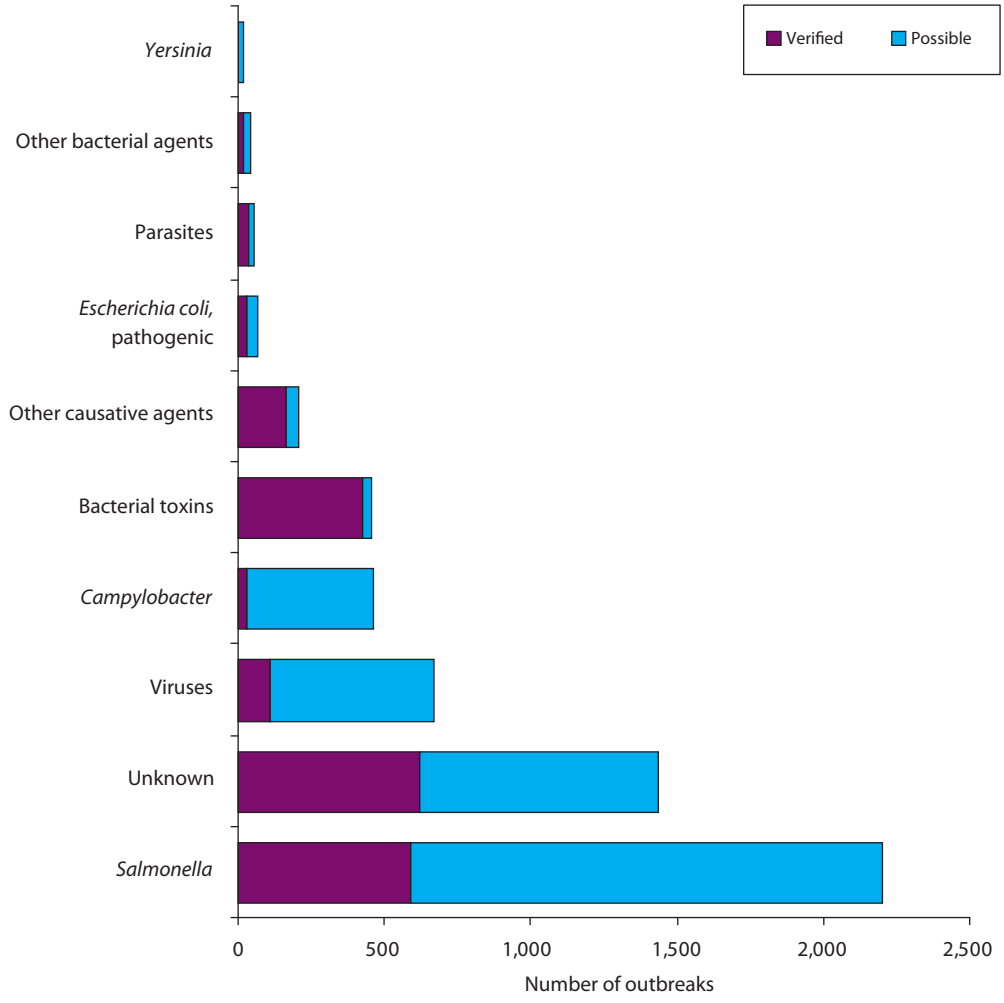
Salmonella remained the most common zoonotic agent in food-borne outbreaks reported in the EU. In 2007, *Salmonella* was responsible for 39.2% of all reported outbreaks (53.9% in 2006) and 29.1% of all verified outbreaks. *Campylobacter* caused 8.2% of all reported outbreaks and 6.5% of them were verified. As in 2006, food-borne viruses were more commonly reported as the cause of the outbreaks than *Campylobacter*. In 2007, 11.9% of all reported outbreaks and 5.5% of all verified outbreaks were caused by food-borne viruses. In 25.5% of all outbreaks the causative agents were unknown (Table GE5).

Toxins were the causative agent with the highest proportion of verified outbreaks; 93.2% of reported outbreaks due to a bacterial toxin were verified. In outbreaks caused by other causative agents 79.4% were verified (Figure GE4).

Table GE5. | ***Causative agents in food-borne outbreaks, 2007***

Causative agent	N	%	Possible outbreaks (N)	Verified outbreaks (N)
Salmonella	2,201	39.2	1,611	590
Unknown	1,433	25.5	811	622
Viruses	668	11.9	557	111
Campylobacter	461	8.2	431	30
Bacterial toxins	458	8.2	31	427
Other causative agents	204	3.6	42	162
Escherichia coli, pathogenic	65	1.2	36	29
Parasites	57	1.0	22	35
Other bacterial agents	40	0.7	23	17
Yersinia	22	0.4	20	2
EU Total	**5,609**	**100**	**3,584**	**2,025**

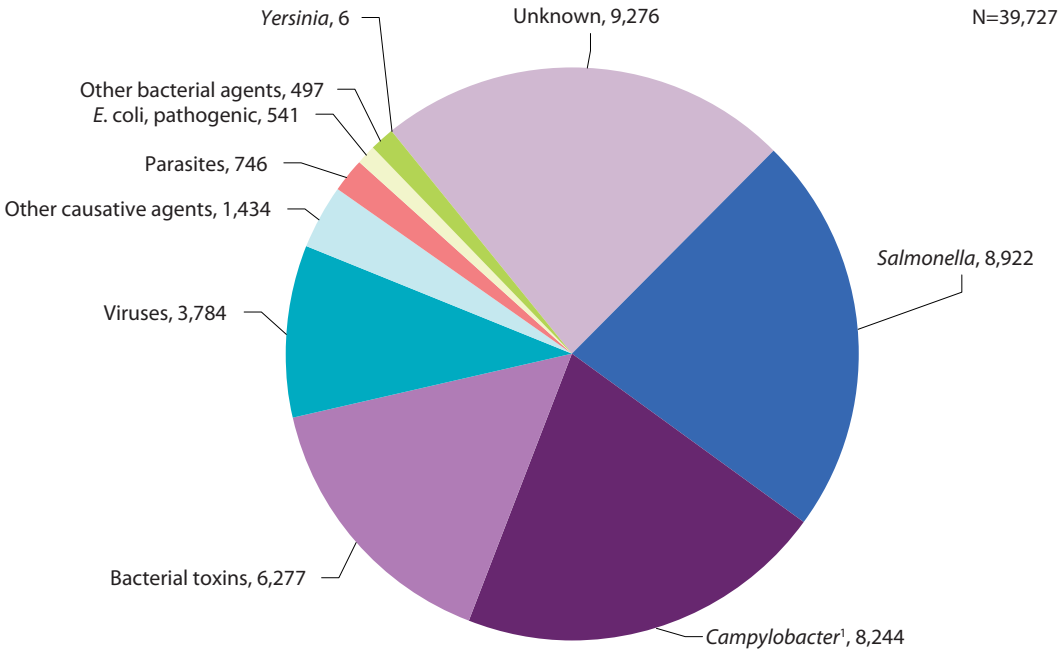
Figure GE4. | ***Causative agents in food-borne outbreaks, 2007***



Note: food-borne viruses include calicivirus, flavivirus, rotavirus, hepatitis A virus and other unspecified food-borne viruses. Bacterial toxins include toxins produced by *Bacillus*, *Clostridium* and *Staphylococcus*. Other causative agents include mushroom toxins, marine biotoxins, histamine, lectins and other unspecified agents. Parasites include primarily *Trichinella*, but also *Sarcocystis*, *Cryptosporidia* and *Giardia*. Other bacterial agents include *Listeria*, *Enterobacter*, *Citrobacter*, and *Shigella*

Three groups of causative agents were the primary cause of human cases related to food-borne outbreaks reported in the EU in 2007 (Figure GE5). *Salmonella* caused 8,922 human cases, bacterial toxins caused a total of 6,277 human cases and viruses caused 3,784 human cases.

Figure GE5. | ***Distribution of total number of human cases per causative agent in verified outbreaks, 2007***



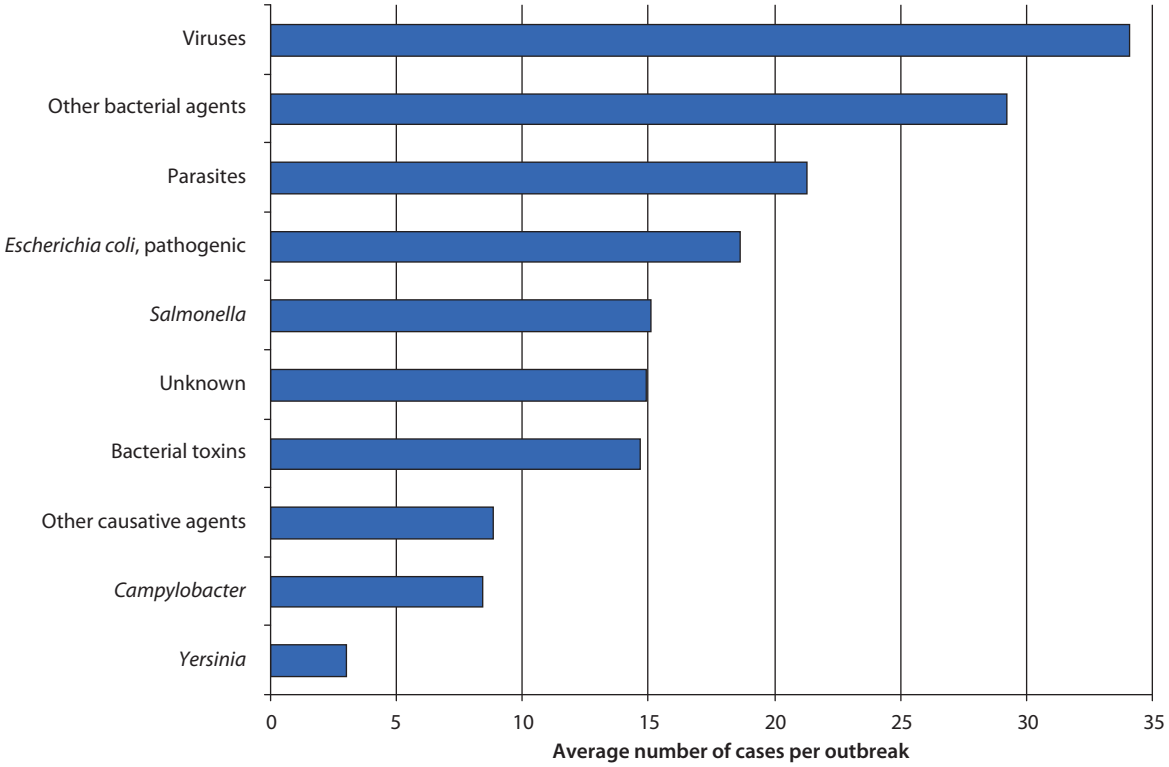
Note: includes data from 2,025 outbreaks: AT (11), BE (21), CZ (4), DK (57), EE (2), FI (32), FR (984), DE (62), HU (52), IE (5), LV (15), LT (10), NL (37), PL (155), RO (37), SK (17), SI (17), ES (495) and SE (12)

Food-borne viruses include calicivirus, flavivirus, rotavirus, hepatitis A virus and other unspecified food-borne viruses. Bacterial toxins include toxins produced by *Bacillus*, *Clostridium* and *Staphylococcus*. Other causative agents include mushroom toxins, marine biotoxins, histamine, lectins and other unspecified agents. Parasites include primarily *Trichinella*, but also *Sarcocystis*, *Cryptosporidia* and *Giardia*. Other bacterial agents include *Listeria*, *Enterobacter*, *Citrobacter* and *Shigella*

1. Includes the large waterborne outbreak with 8,000 cases where also other causative agents were involved

Outbreaks caused by food-borne viruses are generally characterised by affecting more cases per outbreak than other zoonotic agents. In 2007, on average, food-borne reported outbreaks caused by viruses involved 34 cases, which was twice the case number caused by *Salmonella* and four times more than food-borne *Campylobacter* cases (excluding the large waterborne *Campylobacter* outbreak) (Figure GE6). However, more cases with salmonellosis (19.9%) were admitted to a hospital compared to cases affected by food-borne viruses (3.5%). In 2007, 35 outbreaks were caused by parasites resulting in, on average, more than 21 cases per outbreak and in the hospitalisation of 45.2% of cases. In total, 19 deaths were reported due to food-borne outbreaks of which ten deaths were caused by *Salmonella*.

Figure GE6. | ***Average number of human cases per verified outbreak, 2007***



Note: a large waterborne outbreak caused by *Campylobacter* involving 8,000 human cases has been excluded from the graph

Salmonella | 3.2

3.2 | *Salmonella*

Salmonella is as an important zoonotic pathogen with a significant economic and health impact on animals and humans. The genus *Salmonella* is currently divided into two species: *S. enterica* and *S. bongori*. *S. enterica* is further divided into six subspecies and most *Salmonella* belong to the subspecies *S. enterica* subsp. *enterica*. Members of this subspecies have usually been named based on where the serovar was first isolated. In the following text, the organisms are identified by genus followed by serovar, e.g. *S.* Typhimurium. More than 2,500 serovars of zoonotic *Salmonella* exist and the prevalence of the different serovars changes over time.

Human salmonellosis is usually characterised by the acute onset of fever, abdominal pain, nausea, and sometimes vomiting. The incubation period is from 6 to 72 hours, usually about 12-36 hours. Symptoms are often mild and most infections are self-limiting, lasting a few days. However, in some patients, the infection may be more serious and the associated dehydration can be life-threatening. In these cases, as well as when *Salmonella* causes bloodstream infection, effective antimicrobials are essential for treatment. Salmonellosis has also been associated with long-term and sometimes chronic sequelae e.g. reactive arthritis.

The common reservoir of *Salmonella* is the intestinal tract of a wide range of domestic and wild animals which result in a variety of foodstuffs covering both food of animal and plant origin as sources of infections. Transmission often occurs when organisms are introduced in food preparation areas and are allowed to multiply in food e.g. due to inadequate storage temperatures, inadequate cooking or cross-contamination of ready-to-eat food. The organism may also be transmitted through direct contact with infected animals or faecally contaminated environments and humans.

Overall in the EU, *S.* Enteritidis and *S.* Typhimurium are the serovars most frequently associated with human illness. Human *S.* Enteritidis cases are most commonly associated with the consumption of contaminated eggs and broiler meat, while *S.* Typhimurium cases are most often associated with the consumption of contaminated pig, poultry and bovine meat.

Food-borne *Salmonella* outbreaks in 2007

Twenty-two MSs reported a total of 2,201 food-borne outbreaks of human salmonellosis, which constituted 39.2% of the total number of reported food-borne outbreaks in the EU (Table GE5).

In 2007, six MSs, Austria, France, Germany, Hungary, Poland and Spain accounted for 86.7% of *Salmonella* outbreaks. The overall reporting rate in the EU was 0.53 per population of 100,000, ranging from an outbreak of less than 0.1 per 100,000 in Belgium, Romania and the United Kingdom to 3.68 outbreaks per population of 100,000 in Austria. The two non-MSs reported a total of seven outbreaks (Table SA1).

The total number of *Salmonella* outbreaks within the EU has decreased markedly over the last three years, from 3,190 outbreaks in 2005 to 2,201 outbreaks in 2007; this is the case especially for the total number of *Salmonella* outbreaks reported by Slovakia and Spain (Table SA1). In particular, Slovakia has reduced the reporting of small household outbreaks over the years. In 2006, these reporting procedures were changed in these MSs. However, the overall decrease in *Salmonella* outbreaks may also be linked to the general decline of human salmonellosis cases that has been observed within the EU (Community Summary Report on Zoonoses 2007)[16].

In the EU, 26.8% of the total reported *Salmonella* outbreaks were verified. The verified outbreaks were reported primarily by France, Germany, Poland and Spain, who accounted for 24.1%, 8.5%, 20.7%, and 31.7%, respectively (Table SA2). In total, 19.9% of human cases in verified outbreaks reported by MSs were hospitalised and the case fatality rate among hospitalised cases was 0.6% (Table SA2).

16. The Community Summary Report on Trends and Sources of Zoonoses and Zoonotic Agents in the European Union in 2007, *The EFSA Journal* (2009), 223

Table SA1. | ***Reported food-borne outbreaks caused by* Salmonella, *2005-2007***

Country	2007				2006	2005
	N	Reporting rate per 100,000[1]	Verified outbreaks	% Verified outbreaks	N	N
Austria	305	3.68	8	2.6	453	477
Belgium	8	0.08	3	37.5	14	21
Czech Republic	25	0.24	3	12.0	62	74
Denmark	7	0.13	7	100	14	29
Estonia	25	1.86	2	8.0	19	17
Finland	6	0.11	6	100	1	3
France	142	0.22	142	100	160	-
Germany	843	1.02	50	5.9	908	796
Greece	29	0.26	0	0	40	32
Hungary	181	1.80	11	6.1	93	-
Ireland	5	0.12	1	20.0	9	-
Italy	-	-	-	-	60	90
Latvia	31	1.36	9	29.0	47	14
Lithuania	58	1.71	6	10.3	76	26
Malta	6	1.47	0	0	-	6
Netherlands	16	0.10	3	18.8	18	14
Poland	251	0.66	122	48.6	292	347
Portugal	-	-	-	-	1	2
Romania	5	0.02	5	100	10	-
Slovakia	34	0.63	8	23.5	452	745
Slovenia	14	0.70	14	100	17	11
Spain	187	0.42	187	100	338	444
Sweden	15	0.16	3	20.0	9	9
United Kingdom	8	0.01	0	0	28	33
EU Total	**2,201**	**0.53**	**590**	**26.8**	**3,121**	**3,190**
Norway	4	0.09	4	100	9	7
Switzerland	3	0.04	3	100	1	0

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Table SA2. | ***Verified food-borne outbreaks caused by* Salmonella, *2007***

Country	Outbreaks			Human cases				
	N	% of EU total	Reporting rate per 100,000[1]	Cases	Cases/ outbreak	Hospitali-sations	Hospitali-sations/ outbreak	Deaths
Austria	8	1.4	0.10	126	15.8	11	1.4	0
Belgium	3	0.5	0.03	17	5.7	6	2.0	0
Czech Republic	3	0.5	0.03	88	29.3	15	5.0	0
Denmark	7	1.2	0.13	97	13.9	7	1.0	0
Estonia	2	0.3	0.15	18	9.0	4	2.0	1
Finland	6	1.0	0.11	75	12.5	10	1.7	0
France	142	24.1	0.22	1,428	10.1	204	1.4	0
Germany	50	8.5	0.06	1,537	30.7	412	8.2	1
Hungary	11	1.9	0.11	400	36.4	60	5.5	0
Ireland	1	0.2	0.02	52	52.0	16	16.0	0
Latvia	9	1.5	0.39	35	3.9	15	1.7	2
Lithuania	6	1.0	0.18	126	21.0	42	7.0	0
Netherlands	3	0.5	0.02	259	86.3	67	22.3	0
Poland	122	20.7	0.32	1,496	12.3	409	3.4	0
Romania	5	0.8	0.02	269	53.8	127	25.4	0
Slovakia	8	1.4	0.15	284	35.5	56	7.0	0
Slovenia	14	2.4	0.70	638	45.6	65	4.6	5
Spain	187	31.7	0.42	1,735	9.3	242	1.3	1
Sweden	3	0.5	0.03	242	80.7	5	1.7	0
EU Total	**590**	**100**	**0.14**	**8,922**	**15.1**	**1,773**	**3.0**	**10**
Norway	4		0.09	95	23.8	6	1.5	0
Switzerland	3		0.04	45	15.0	6	2.0	0

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Detailed information from verified outbreaks

A total of 590 verified *Salmonella* outbreaks were reported by MSs. However, detailed information on outbreaks was only available from the 403 outbreaks presented in Tables SA5 to SA10, because Spain reported aggregated data (187 outbreaks). Data from Spain had sufficient information to be included in the presentation of the distribution of implicated foodstuffs and settings (Figures SA1-SA5), and in the presentation of reported serovars and evidence in verified outbreaks (Tables SA3 and SA4, respectively). All figures and tables with detailed information on verified *Salmonella* outbreaks are presented at the end of this section.

As in 2006, *S.* Enteritidis was the predominant serovar associated with *Salmonella* outbreaks in 2007 (Table SA3) and accounted for 60.2% of all verified *Salmonella* outbreaks, 66.6% of all human *Salmonella* cases, 77.8% of all hospitalisations and 100% of all case fatalities in 2007. *S.* Typhimurium was associated with 10.7% of the verified outbreaks, 12.0% of all human cases, and 10.5% of all hospitalisations in 2007. For 24.7% of the verified outbreaks caused by *Salmonella* the serovar was not reported or was unknown. Very few outbreaks include precise information of the isolated phage type. MSs reported on average 15.1 human cases per outbreak, varying from 3.9 to 86.3 cases, and on average 3.0 hospitalisations per outbreak.

Table SA3. | **Salmonella *serovars reported for food-borne outbreaks*[1], 2007**

Serovar	Phage types	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
S. Enteritidis	Unspecified	313	53.1	4,117	903	9
	PT 4	18	3.1	1,002	353	1
	PT 8	11	1.9	367	89	0
	PT 2	3	0.5	173	2	0
	PT 21	3	0.5	64	0	0
	PT 1	2	0.3	29	7	0
	PT 13	1	0.2	21	5	0
	PT 25	1	0.2	32	9	0
	PT 43	1	0.2	54	7	0
	PT 6	1	0.2	70	0	0
	PT 7a	1	0.2	11	4	0
S. Typhimurium	Unspecified	60	10.2	1,022	185	0
	DT 120	2	0.3	46	0	0
	DT 46	1	0.2	5	1	0
S. Agona		2	0.3	40	1	0
S. Anatum		2	0.3	31	0	0
S. Bredeney		2	0.3	14	2	0
S. Heidelberg		2	0.3	25	7	0
S. Newport		2	0.3	9	6	0
S. Virchow		2	0.3	23	2	0
S. Weltevreden		2	0.3	27	0	0
S. Bovismorbificans		1	0.2	15	0	0
S. Brandenburg		1	0.2	2	2	0
S. Coeln		1	0.2	3	3	0
S. group B		1	0.2	26	5	0
S. group D		1	0.2	3	3	0
S. Hadar		1	0.2	10	8	0
S. Infantis		1	0.2	36	0	0
S. Kimuenza		1	0.2	2	2	0
S. Panama		1	0.2	31	4	0
S. Senftenberg		1	0.2	3	0	0
S. Stanley		1	0.2	51	0	0
S. Thompson		1	0.2	2	0	0
Salmonella spp., unspecified		146	24.7	1,556	163	0
EU Total		**590**	**100**	**8,922**	**1,773**	**10**

1. Information only provided for verified outbreaks

The type of evidence verifying the outbreak was detection from human cases in 61.4% of the outbreaks and from the implicated foodstuff in 31.2% of the outbreaks. The causative agent was laboratory characterised both from the implicated foodstuff and human cases in 5.1% of the outbreaks. Analytical epidemiological evidence was presented in 17.6% of the outbreaks (Table SA4). Often more than one type of evidence was included for a specific outbreak.

In 2007, the Netherlands reported a large outbreak caused by Salmonella *Typhimurium FT560; 225 human cases were identified of which 62 were hospitalised. By analytical epidemiological evidence as well as laboratory detection in human cases and in the implicated foodstuff, the source of infection was confirmed to be cheese produced at a local farm.*

Information on the type of outbreak was available for 99.8% of verified outbreaks. It was almost evenly distributed between general outbreaks (52.1%) and household outbreaks (47.6%). However, general outbreaks caused 81.7% of human cases, 77.8% of all cases admitted to hospitals, and seven out of nine case fatalities (Table SA5).

Overall, information on implicated foodstuffs was provided in 87.6% of the verified *Salmonella* outbreaks (Table SA6). As in previous years, eggs and egg products were the foodstuffs most frequently associated with *Salmonella* outbreaks, causing 109 verified outbreaks, involving 824 cases of which 26.6% were admitted to hospital and two died. Inadequately heat treated bakery products using raw eggs were the second most common source of *Salmonella* infections and 22.3% of the cases were admitted to hospital. Outbreaks due to foodstuffs from mixed or buffet meals were also common and had the highest number of cases per outbreak (26.8 cases). The highest percentages of hospitalisation were reported from *Salmonella* infections caused by sweets and chocolate (41.3%) (Table SA6). Figure SA1 shows the distribution of the most common foodstuff implicated in all verified *Salmonella* outbreaks in 2007. The proportion of verified outbreaks caused by broiler meat decreased clearly in the period 2005-2007, whereas the proportion of outbreaks caused by eggs and egg products increased during this period. Further, the outbreaks reported to be caused by pig meat products increased during these years (Figure SA2). However, due to the change in the reporting system, these figures are not directly comparable between the years.

Table SA4. | ***Evidence in verified outbreaks, 2007***

Country	No of outbreaks	Causative agent detected in:		Laboratory characterisation of isolates[1]	Analytical epidemiological evidence	Unknown
		Implicated foodstuff	Human cases			
Austria	8	7	8	6	1	0
Belgium	3	3	3	0	0	0
Czech Republic	3	3	0	0	0	0
Denmark	7	3	6	1	0	0
Estonia	2	2	2	0	2	0
Finland	6	5	6	2	5	0
France	142	17	121	0	28	0
Germany	50	48	50	3	4	0
Hungary	11	8	10	8	1	0
Ireland	1	0	1	0	1	0
Latvia	9	2	7	0	0	0
Lithuania	6	1	0	0	5	0
Netherlands	3	1	3	1	3	0
Poland	122	68	119	0	52	2
Romania	5	4	1	0	0	0
Slovakia	8	8	8	8	0	0
Slovenia	14	3	14	1	0	0
Spain	187	0	0	0	0	187
Sweden	3	1	3	0	2	0
EU Total	**590**	**184**	**362**	**30**	**104**	**189**
Norway	4	1	4	1	1	0
Switzerland	3	2	3	0	1	0

Note: countries can report more than one type of evidence per outbreak

1. *Salmonella* spp. is detected in both human cases and implicated foodstuffs. Laboratory characterisation for all isolates may include serotyping according to the Kaufmann White scheme, antimicrobial resistance pattern and genotyping (PFGE). Laboratory characterisation of *S.* Typhimurium isolates may include phage typing, and for common phage types (e.g. DT 104), molecular typing (plasmid profiling) and genotyping (MLVA). Laboratory characterisation of *S.* Enteritidis isolates may include phage typing, and for common phage types (e.g. PT4), molecular typing (ribotyping speciation) and genotyping (e.g. MLVA, AFLP, MLST)

Table SA5. | ***Type of verified outbreaks caused by* Salmonella, *2007***

Type	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
General	210	52.1	5,875	1,191	7
Household	192	47.6	1,306	338	2
Unknown	1	0.2	6	2	0
EU Total	**403**	**100.0**	**7,187**	**1,531**	**9**

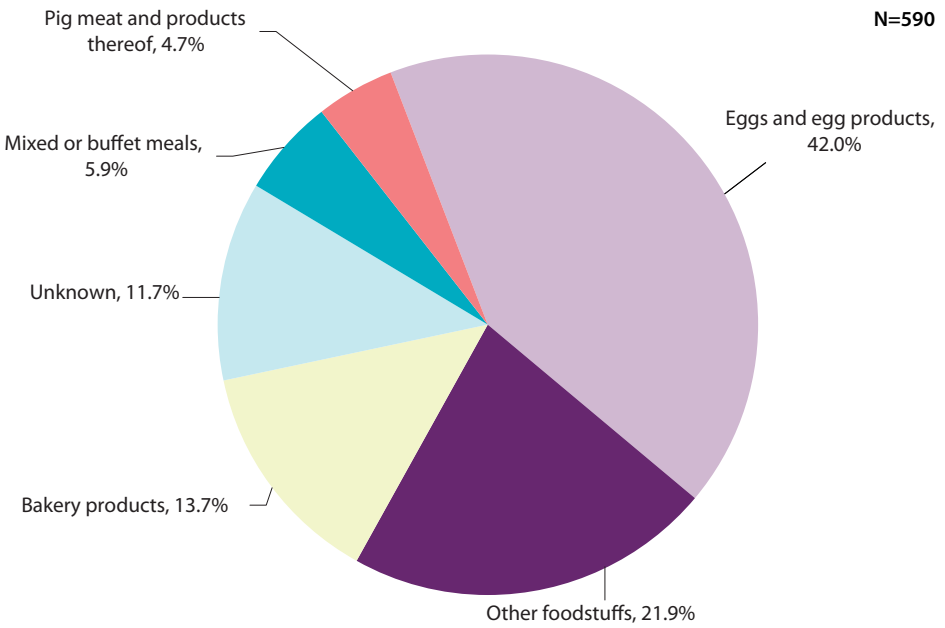
Note: Spain (N=187) is not included due to reporting aggregated data

Table SA6. | ***Implicated foodstuffs in verified outbreaks caused by* Salmonella, *2007***

Implicated foodstuff	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Bakery products	71	17.6	1,175	262	1
Bovine meat and products thereof	9	2.2	173	32	0
Broiler meat (*Gallus gallus*) and products thereof	15	3.7	329	40	0
Cereal products including rice and seeds/pulses (nuts, almonds)	2	0.5	34	14	0
Cheese	2	0.5	255	62	0
Crustaceans, shellfish, molluscs and products thereof	2	0.5	13	2	0
Dairy products (other than cheeses)	12	3.0	529	120	0
Eggs and egg products	109	27.0	824	219	2
Fish and fish products	3	0.7	6	5	0
Herbs and spices	1	0.2	3	0	0
Mixed or buffet meals	35	8.7	937	202	0
Other or mixed red meat and products thereof	15	3.7	134	45	0
Other or unspecified poultry meat and products thereof	2	0.5	12	2	0
Pig meat and products thereof	28	6.9	619	81	0
Sheep meat and products thereof	1	0.2	34	0	0
Sweets and chocolate	8	2.0	242	100	0
Turkey meat and products thereof	3	0.7	24	5	0
Vegetables and juices and other products thereof	5	1.2	302	12	0
Other foods	30	7.4	1,010	273	6
Unknown	50	12.4	532	55	0
EU Total	**403**	**100**	**7,187**	**1,531**	**9**

Note: Spain (N=187) is not included due to reporting aggregated data

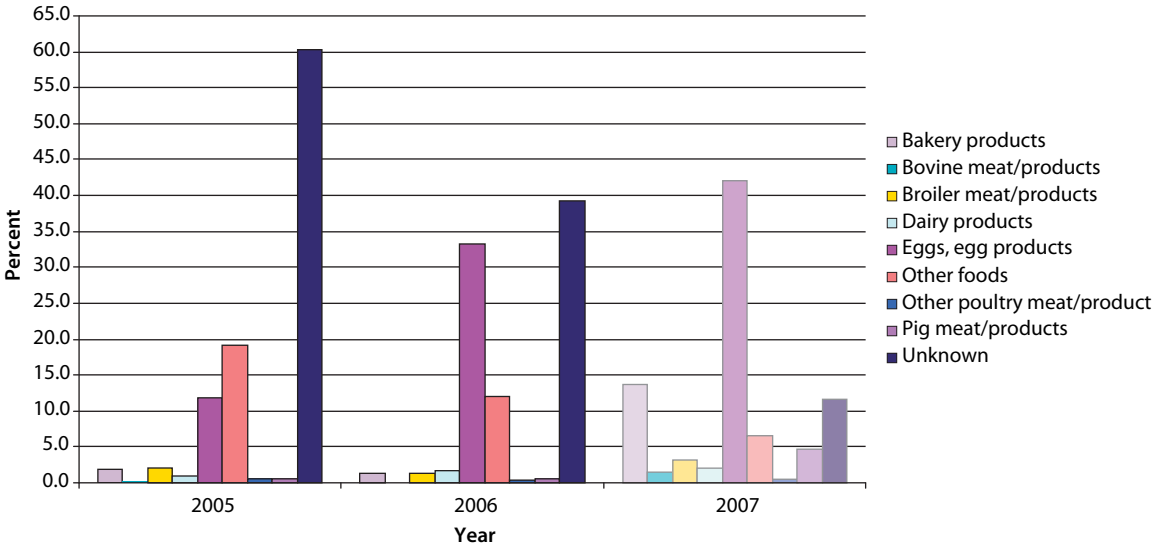
Figure SA1. | ***Distribution of implicated foodstuffs in verified outbreaks caused by* Salmonella*, 2007***



Note: includes data from 590 outbreaks: AT (8), BE (3), CZ (3), DK (7), EE (2), FI (6), FR (142), DE (50), HU (11), IE (1), LV (9), LT (6), NL (3), PL (122), RO (5), SK (8), SI (14), ES (187), SE (3)

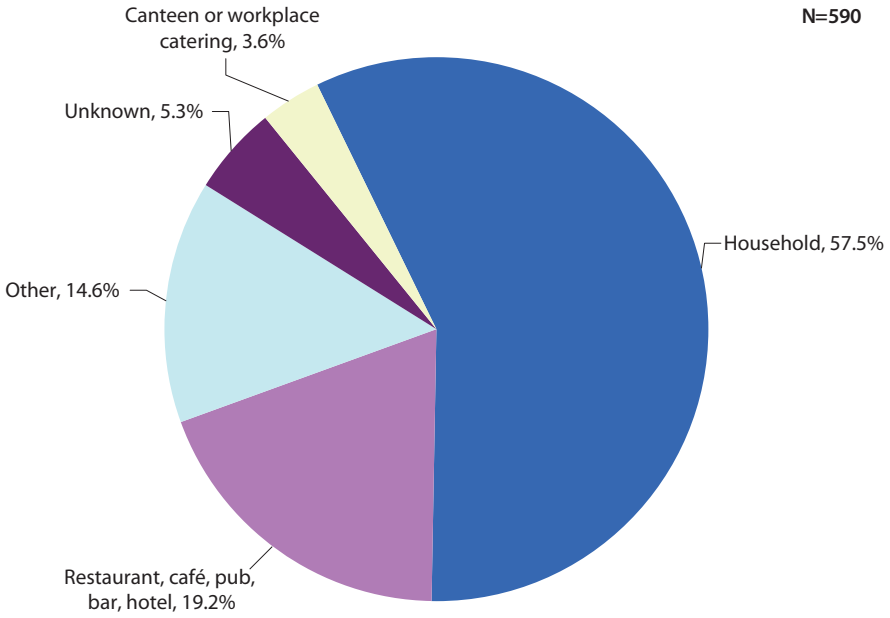
Other foodstuffs (N=129) include: broiler meat (*Gallus gallus*) and products thereof (19), other or mixed red meat and products thereof (17), dairy products (other than cheeses) (12), bovine meat and products thereof (9), sweets and chocolate (8), vegetables and juices and other products thereof (5), fish and fish products (3), cheese (3), tap water, including well water (3), turkey meat and products thereof (3), crustaceans, shellfish, molluscs and products thereof (2), cereal products including rice and seeds/pulses (nuts, almonds) (2), other or unspecified poultry meat and products thereof (2), herbs and spices (1), sheep meat and products thereof (1), other foods (39)

Figure SA2. | ***Selected implicated foodstuffs in reported outbreaks caused by* Salmonella*, 2005-2007***



Note: for 2007, includes data from 590 verified outbreaks (19 MSs) and the shade of the bar colour is lighter. For 2006, includes data from all 3,121 reported outbreaks (23 MSs). For 2005, includes data from all 4,149 reported outbreaks (20 MSs). Data for 2007 are presented with a lighter colour shade

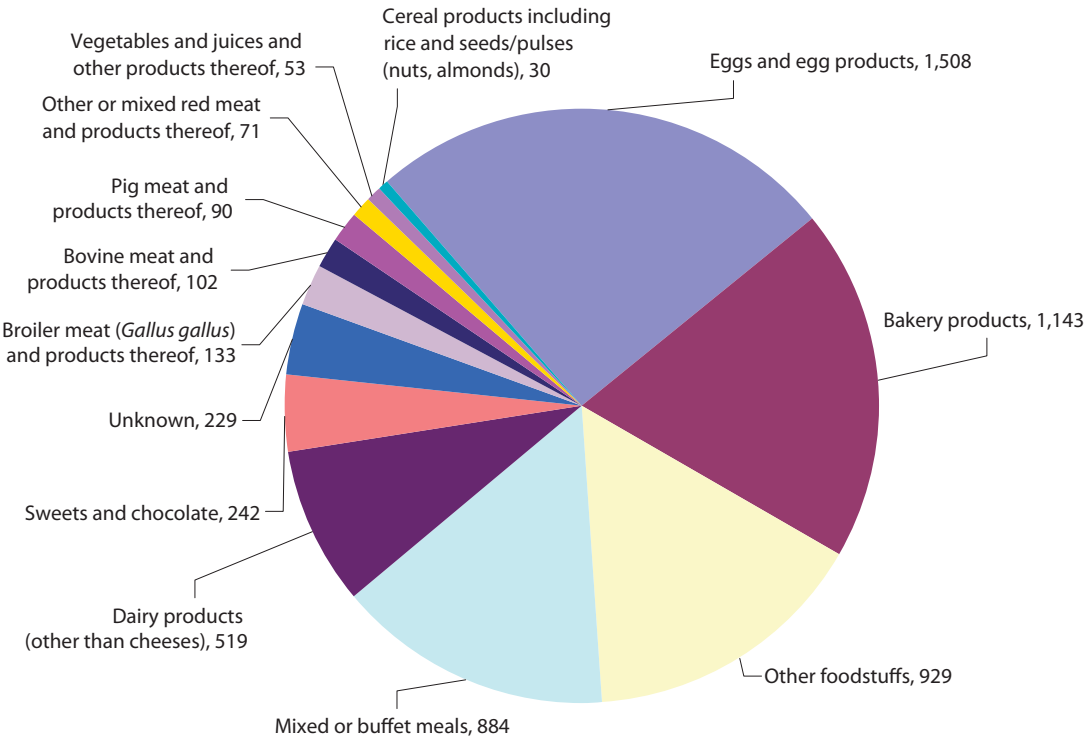
Figure SA3. | ***Distribution of settings in verified outbreaks caused by* Salmonella*, 2007***



Note: includes data from 590 outbreaks: AT (8), BE (3), CZ (3), DK (7), EE (2), FI (6), FR (142), DE (50), HU (11), IE (1), LV (9), LT (6), NL (3), PL (122), RO (5), SK (8), SI (14), ES (187), SE (3)

Reported settings involving less than 20 outbreaks are included in 'other settings': school, kindergarten (19), hospital or medical care facility (12), residential institution (nursing home, prison, boarding school) (11), camp, picnic (4), temporary mass catering (fairs, festivals) (4), take-away or fast-food outlet (1), and other (35)

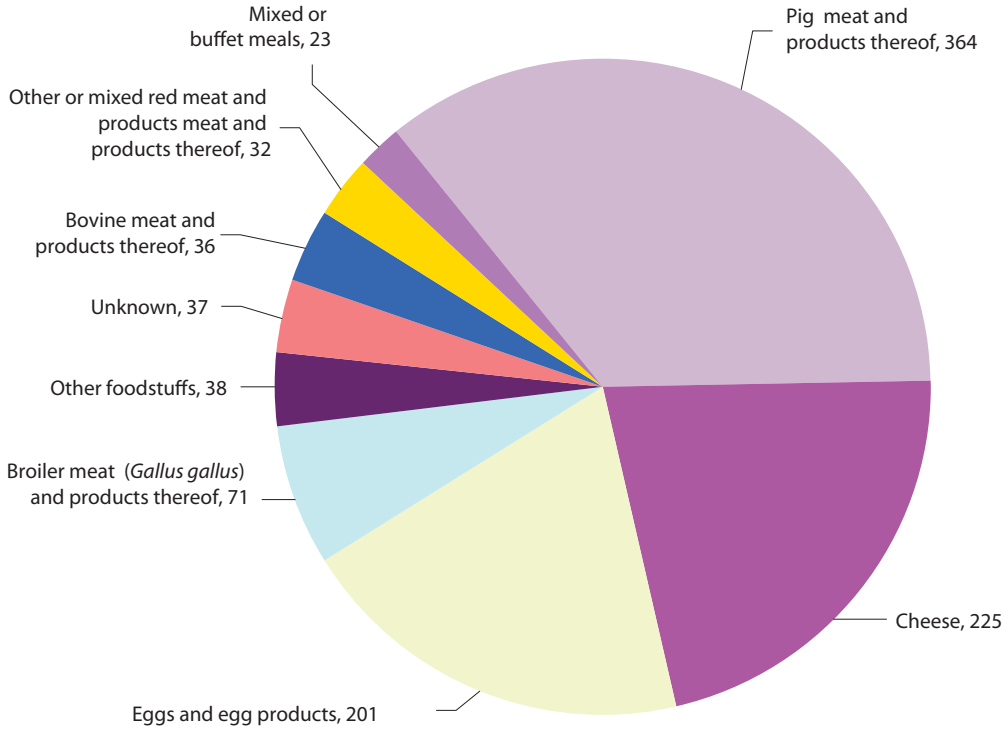
Figure SA4. | ***Number of human cases caused by* Salmonella *Enteritidis in different foodstuffs, 2007***



Note: includes data from 355 outbreaks: AT (7), BE (3), CZ (3), DK (2), EE (2), FR (37), DE (40), HU (10), IE (1), LV (7), LT (6), PL (117), RO (4), SK (8), SI (13), ES (95)

Other foodstuffs include: fish and fish products (4), turkey meat and products thereof (3)

Figure SA5. | ***Number of human cases caused by* Salmonella *Typhimurium in different foodstuffs, 2007***



Note: includes data from 63 outbreaks: AT (1), DK (2), FI (1), FR (44), DE (3), NL (1), PL (2), RO (1), ES (8)

Other foodstuffs include: bakery products (15), crustaceans, shellfish, molluscs and products thereof (2), dairy products (other than cheeses) (10), fish and fish products (2), other or unspecified poultry meat and products thereof (9)

The origin of the foodstuff was only reported in 38.5% of all verified *Salmonella* outbreaks (Table SA7) and 94.2% of these originated from domestically produced foodstuffs.

Three Nordic countries, Denmark, Finland and Norway, were affected by a common outbreak with Salmonella *Weltevreden. The outbreak was traced to alfalfa sprouts grown from contaminated seeds imported from Italy.* Salmonella *isolates obtained from a major Danish alfalfa sprouts producer were serotyped as* S. *Weltevreden and had the same Multi Locus Variable-Number Tandem Repeat Analyses (MLVA) and Pulsed Field Gel Electrophoresis (PFGE) profile as the outbreak strain isolated from human cases. The Danish producer had exported part of the batch of seeds to a Norwegian alfalfa sprouts producer. The seeds imported to Finland came from the same company in Italy, but not from the same batch. A total of 45 people were known to be infected in the outbreak; 27 in Norway, 19 in Denmark and eight in Finland.*

Sweden reported a Salmonella *Java outbreak affecting 179 cases. Baby spinach imported from Italy was confirmed by analytical epidemiological evidence and laboratory detection in human cases to be the source of infection. Sweden also reported a* S. *Enteritidis outbreak caused by eggs imported from Poland. The eggs had been used for mayonnaise and the outbreak strain was detected both in food samples and in human stool samples; 12 cases were infected and five cases were hospitalised.*

Households (61.3%) were reported to be the most important settings in verified *Salmonella* outbreaks, involving a total of 2,390 cases; 25.8% of the cases were admitted to hospital and two cases died. In residential institutions (N=9) large and severe outbreaks were reported with more than 700 cases and five deaths (Table SA8). Figure SA3 shows the distribution of the most common settings implicated in all verified *Salmonella* outbreaks in 2007 reported by 19 MSs (including Spain). *S.* Enteritidis caused the highest number of human cases from egg and egg products, bakery products using raw eggs, and in mixed or buffet meals (Figure SA4). *S.* Typhimurium caused the highest number of human cases from pig meat, cheeses, and eggs and egg products (Figure SA5).

In Slovenia, an outbreak in a home for the elderly infected 420 out of 580 inhabitants; 39 were hospitalised and five people died. Salmonella *Enteritidis was microbiologically detected from human cases and food samples and the PFGE profile confirmed that similarity between the strains was more than 99%. The implicated foodstuff was a salad of string beans, probably cross-contaminated from meat. Storage time and temperature abuse had been contributory factors in the outbreak.*

The place of origin of the problem was only reported for 9.2% of all verified outbreaks caused by *Salmonella* (Table SA9). The largest number of human cases (456 in six outbreaks) originated from problems in primary production. Catering services and restaurants were reported as the origin of the problem in 11 outbreaks causing 311 cases of which 33.8% were hospitalised.

More than one contributing factor can be notified per verified outbreak. Information on contributory factors was provided in 50.4% of outbreaks. Inadequate heat treatment and unprocessed contaminated ingredients were the most common causes reported: 35.5% and 32.5% respectively of verified outbreaks where information on contributory factors is available. In 6.5% of outbreaks an infected food handler was reported as the contributory factor (Table SA10).

Two large Salmonella *Enteritidis outbreaks occurred in German hospitals. Analytical epidemiological studies incriminated several desserts – none of which contained eggs. In one of the outbreaks, the outbreak strain was isolated from a salad dressing sample and from the laying flock at a farm supplying eggs used in cakes and other foods in the hospital kitchen. Both symptomatic and asymptomatic* Salmonella *carrier food workers were identified, who probably prolonged the outbreak. It was concluded that the kitchen most likely had been contaminated through the use of shell eggs. A consecutive infection of food handlers and cross-contamination of the foodstuff consumed by the patients had prolonged the outbreak. In the second outbreak, both symptomatic and asymptomatic food handlers were also identified. Sub-typing of the outbreak strains revealed that each outbreak was caused by a different strain, which explained the absence of an epidemiological link between the outbreaks.*

In Germany, an increase in cases with Salmonella *Panama infections was detected and more than 30 young children were infected. A case-control study implicated consumption of short-fermented mini-salami sticks as the likely source of infection. Simultaneously to the beginning of the outbreak, a food handler was diagnosed with an asymptomatic .* S. *Panama infection. The food handler was employed in a factory producing short-fermented mini-salami sticks marketed under various brand names. Some of the brands were associated with an increased risk of infection in the case-control study.* S. *Panama could not be isolated from mini-salami sampled at retail or from samples at producer level. A microbiologically similar strain of* S. *Panama was found in pork sampled in another part of Germany, indicating that it was the pig meat ingredient and not the food handler that contaminated the implicated foodstuff.*

Table SA7. | ***Origin of implicated foodstuffs in verified outbreaks caused by* Salmonella, *2007***

Origin	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Domestic	146	36.2	2,054	565	3
Intra community trade	9	2.3	456	118	0
Unknown	248	61.5	4,677	848	6
EU Total	**403**	**100**	**7,187**	**1,531**	**9**

Note: Spain (N=187) is not included due to reporting aggregated data

Table SA8. | ***Settings in verified outbreaks caused by* Salmonella, *2007***

Setting	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Camp, picnic	4	1.0	38	7	0
Canteen or workplace catering	12	3.0	304	31	0
Hospital or medical care facility	12	3.0	558	248	1
Household	247	61.3	2,390	617	2
Residential institution (nursing home, prison, boarding school)	9	2.2	707	112	5
Restaurant, café, pub, bar, hotel	67	16.6	1,348	203	1
School, kindergarten	15	3.7	832	144	0
Take-away or fast-food outlet	1	0.2	3		0
Temporary mass catering (fairs, festivals)	4	1.0	138	27	0
Other setting	25	6.2	740	119	0
Unknown	7	1.7	129	23	0
EU Total	**403**	**100**	**7,187**	**1,531**	**9**

Note: Spain (N=187) is not included due to reporting aggregated data

Table SA9. | ***Origin of the problem in verified outbreaks caused by* Salmonella, *2007***

Origin	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Catering services, restaurant	11	2.7	311	105	1
Farm (primary production)	6	1.5	456	73	0
Household, domestic kitchen	13	3.2	217	65	2
Processing plant	2	0.5	103	16	0
Retail sale outlet	2	0.5	7	4	0
Take-away	1	0.2	1	1	0
Travel abroad	2	0.5	78	3	0
Unknown	366	90.8	6,014	1,264	6
EU Total	**403**	**100**	**7,187**	**1,531**	**9**

Note: Spain (N=187) is not included due to reporting aggregated data

Table SA10. | ***Contributory factors in verified outbreaks caused by* Salmonella*, 2007***

Factor	Number of reportings
Cross-contamination	25
Inadequate chilling	11
Inadequate heat treatment	72
Infected food handler	26
Storage time/temperature abuse	23
Unprocessed contaminated ingredient	66
Other contributory factor	11
Unknown	200
EU Total	**434**

Note: MSs can report more than one contributory factor per outbreak

Spain (N=187) is not included due to reporting aggregated data

Campylobacter | 3.3

3.3 | *Campylobacter*

Campylobacteriosis in humans is caused by thermophilic *Campylobacter* spp.. The species most commonly associated with human infection are *C. jejuni* followed by *C. coli* and *C. lari*, but other *Campylobacter* species are also known to cause human infections. Typically, the infective dose of these bacteria is low.

The incubation period in humans averages from two to five days. Patients may have mild to severe symptoms, with common clinical symptoms including watery, often bloody diarrhoea, abdominal pain, fever, headache and nausea. Usually, infections are self-limiting and last only a few days. Infrequently, extra-intestinal infections or post-infection complications such as reactive arthritis and neurological disorders occur. *C. jejuni* has become the most recognised antecedent cause of Guillain-Barré syndrome, a polio-like form of paralysis that can result in respiratory and severe neurological dysfunction and even death.

Thermophilic *Campylobacter* are widespread in nature. The principal reservoirs are the alimentary tracts of wild and domestic birds and mammals. They are prevalent in food animals such as poultry, pigs, cattle and sheep; in pets, including cats and dogs; in wild birds and in environmental water sources. Animals, however, rarely succumb to disease caused by these organisms.

The bacteria can readily contaminate various foodstuffs, including meat, raw milk and dairy products, and less frequently fish and fishery products, mussels and fresh vegetables. Among sporadic human cases, contact with live poultry, consumption of raw or undercooked meat, drinking water from untreated water sources, and contact with pets and other animals have been identified as the major sources of infection. Raw milk and contaminated drinking water have been causes of larger outbreaks.

Campylobacter outbreaks in 2007

Seventeen MSs reported a total of 461 food-borne outbreaks of human campylobacteriosis, which constituted 8.2% of the total number of reported food-borne outbreaks in the EU (Table GE5).

In 2007, Austria and Germany accounted for 79.6% of reported *Campylobacter* outbreaks. The overall reporting rate in the EU was 0.11 per population of 100,000, ranging from 0.01 per 100,000 in Poland and Spain to 1.47 per population of 100,000 in Malta. The two non-MSs reported seven *Campylobacter* outbreaks (Table CA1).

The total number of *Campylobacter* outbreaks within the EU increased by 16.7% compared to 2006 (Table CA1). However in the EU only 6.5% of the total reported *Campylobacter* outbreaks were classified as verified (Table CA2). The verified outbreaks were reported primarily from France and Denmark, who accounted for 33.3% and 20.0% of these outbreaks, respectively. In total and excluding the large waterborne outbreak with several causative agents, 7.8% of human cases in the verified outbreaks reported by MSs were hospitalised. MSs reported on average 8.4 cases and 0.7 hospitalisations per outbreak. No case fatalities were reported.

Table CA1. | ***Reported food-borne outbreaks caused by* Campylobacter, *2005-2007***

Country	2007				2006	2005
	N	Reporting rate per 100,000[1]	Verified outbreaks	% Verified outbreaks	N	N
Austria	108	1.30	0	0	136	133
Belgium	2	0.02	0	0	5	4
Czech Republic	3	0.03	0	0	2	5
Denmark	6	0.11	6	100	2	22
Estonia	1	0.07	0	0	4	-
Finland[2]	3	0.06	3	100	1	4
France	10	0.02	10	100	9	-
Germany	259	0.31	1	0.4	208	269
Hungary	33	0.33	0	0	10	-
Ireland	2	0.05	0	0	4	-
Italy	-	-	-	-	1	-
Latvia	-	-	-	-	-	-
Lithuania	4	0.12	0	0	1	2
Malta	6	1.47	0	0	-	10
Netherlands	12	0.07	2	16.7	5	10
Poland	3	0.01	3	100	3	-
Spain	4	0.01	4	100	4	4
Sweden	2	0.02	1	50.0	-	9
United Kingdom	3	<0.01	0	0	-	8
EU Total	**461**	**0.11**	**30**	**6.5**	**395**	**480**
Norway	6	0.13	6	100	3	3
Switzerland	1	0.01	1	100	2	0

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs
2. Includes one large waterborne outbreak involving other causative agents such as norovirus and *Giardia* and affecting together 8,000 people, with 200 *Campylobacter* infection cases confirmed

Table CA2. | ***Verified food-borne outbreaks caused by* Campylobacter, *2007***

Country	Outbreaks		Human cases					
	N	% of EU total	Reporting rate per 100,000[1]	Cases	Cases/ outbreak	Hospitalisations	Hospitalisations/ outbreak	Deaths
Denmark	6	20.7	0.11	27	4.5	3	0.5	0
Finland[2]	2	6.9	0.04	11	5.5	0	0	0
France	10	34.5	0.02	91	9.1	15	1.5	0
Germany	1	3.4	<0.01	14	14.0	0	0	0
Netherlands	2	6.9	0.01	20	10.0	0	0	0
Poland	3	10.3	0.01	4	1.3	0	0	0
Spain	4	13.8	0.01	55	13.8	1	0.3	0
Sweden	1	3.4	0.01	22	22.0	0	0	0
EU Total	**29**	**100**	**0.01**	**244**	**8.4**	**19**	**0.7**	**0**
Norway	6		0.13	1,040	173.3	9	1.5	0
Switzerland	1		0.01	13	13.0	2	2.0	0

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs
2. Excludes the large waterborne outbreak involving other causative agents such as norovirus and *Giardia* and affecting together 8,000 people, with 200 *Campylobacter* infection cases confirmed

Detailed information from verified outbreaks

In this analysis the large waterborne outbreak in Finland is excluded because it was caused by several causative agents and only some of the human cases were laboratory confirmed. Detailed information on this outbreak is included in the chapter 'Waterborne outbreaks'.

A total of 29 verified food-borne outbreaks (excluding the Finnish waterborne outbreak) caused by *Campylobacter* were reported by MSs. However, detailed information on outbreaks was only available from the 25 outbreaks presented in Tables CA3 to CA9, because Spain reported aggregated data (four outbreaks). However, data from Spain had sufficient information to be included in the graphic presentations. All figures and tables with detailed information on verified *Campylobacter* outbreaks are presented at the end of this section.

The type of evidence verifying the outbreak was detection of the agents from human cases in 79.3% of outbreaks and from the implicated foodstuff in 13.8% of outbreaks. The causative agent was laboratory characterised both from the implicated foodstuff and human cases in 3.4% of outbreaks. Analytical epidemiological evidence was presented in 10.3% of outbreaks (Table CA3).

Information on the type of outbreaks were available for 92.0% of verified outbreaks; 64.0% of outbreaks were categorised as general and caused almost all human cases (87.3%) and hospitalisations (61.1%) (Table CA4).

Overall, information on implicated foodstuffs was provided in 76.0% of verified *Campylobacter* outbreaks (Table CA5). Figure CA1 shows the distribution of the most common foodstuff implicated in all verified *Campylobacter* outbreaks in 2007. Broiler meat and products thereof were reported as the foodstuff category most frequently associated with *Campylobacter* outbreaks in 2007 and the share of outbreaks caused by broiler meat seems to have been increasing over the period 2005-2007, even though this data is not fully comparable (Figure CA2).

The origin of the foodstuff was only reported in 36.0% of verified *Campylobacter* outbreaks (Table CA6) and 77.8% of these originated from domestically produced foodstuffs.

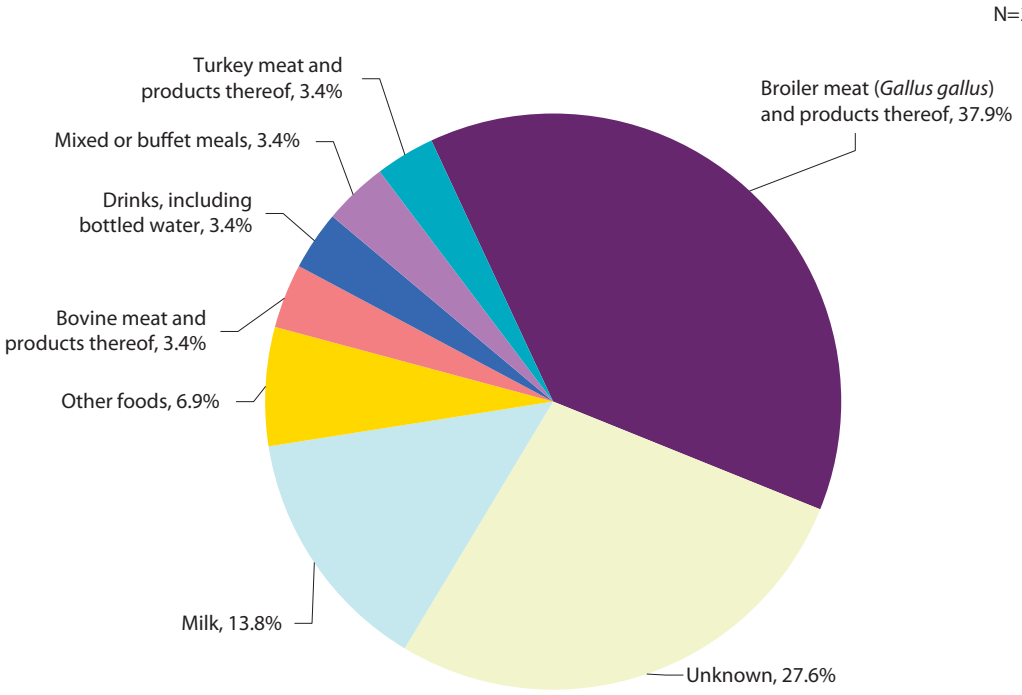
The vast majority of reported settings in verified *Campylobacter* outbreaks were households (52.0%) involving a total of 66 human cases of which eight cases were admitted to hospital (Table CA7). Figure CA3 shows the distribution of the most common settings implicated in all verified *Campylobacter* outbreaks in 2007.

The place of origin of the problem was only reported for 24.0% of the verified outbreaks caused by *Campylobacter* (Table CA8). Farms, restaurants and catering were the ones most often reported.

In 20.0% of the reported verified *Campylobacter* outbreaks, cross-contamination was reported as a contributory factor. Furthermore, the use of unprocessed contaminated ingredients was reported in four outbreaks (Table CA9).

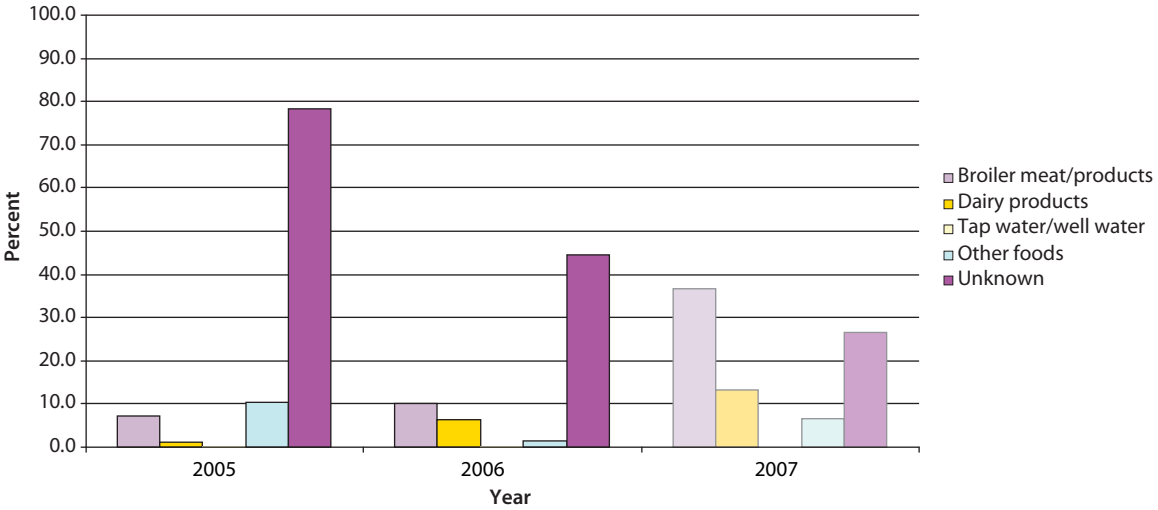
In the Netherlands, 18 people became infected with Campylobacter jejuni *when a group of 23 people visited a dairy farm. Nineteen people had consumed unpasteurised milk during the visit.*

Figure CA1. | ***Distribution of implicated foodstuffs in verified* Campylobacter *outbreaks, 2007***



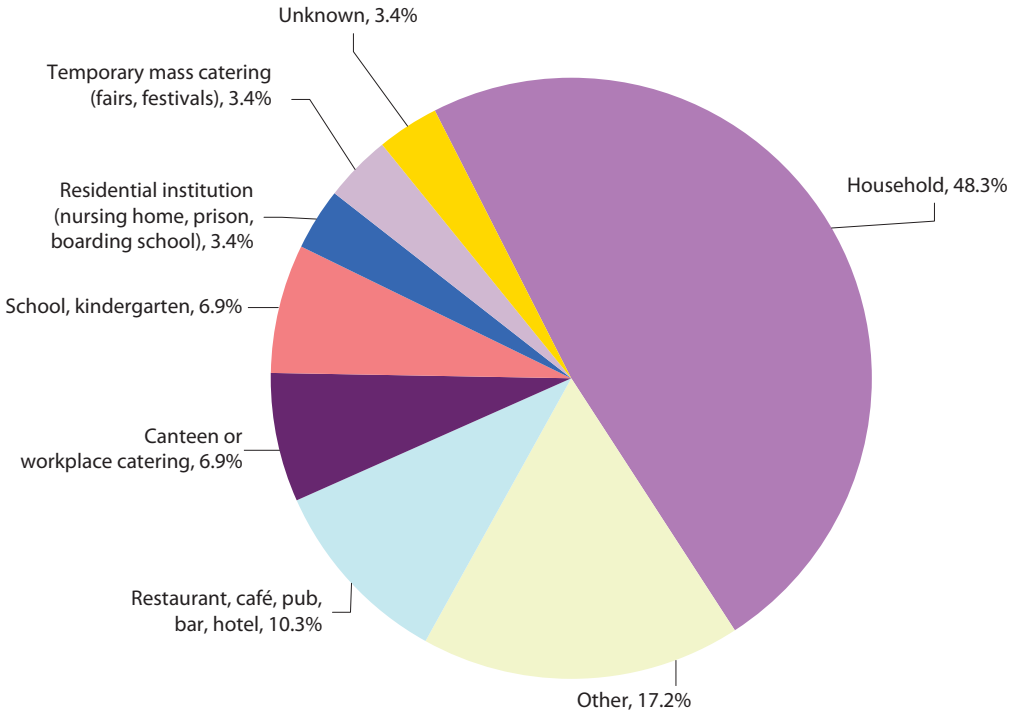
Note: includes data from 29 outbreaks: DK (6), FI (2), FR (10), DE (1), NL (2), PL (3), ES (4), SE (1)

Figure CA2. | ***Proportion of selected implicated foodstuffs in reported outbreaks caused by* Campylobacter*, 2005-2007***



Note: for 2007, only verified outbreaks are included and the shade of the bar colour is lighter. For 2005 and 2006, the total number of outbreaks is included. For 2007 data from 29 verified outbreaks are included: DK (6), FI (2), FR (10), DE (1), NL (2), PL (3), ES (4), SE (1). In 2006 and 2005 data from 395 (16 MSs) and 480 (12 MSs) outbreaks respectively were included. Data for 2007 are presented with a lighter colour shade

Figure CA3. | ***Distribution of settings in verified* Campylobacter *outbreaks, 2007***



Note: includes data from 29 outbreaks: DK (6), FI (2), FR (10), DE (1), NL (2), PL (3), ES (4), SE (1)

Table CA3. | ***Evidence in verified outbreaks, 2007***

Country	N	Causative agent detected in:		Laboratory characterisation of isolates[1]	Analytical epidemiological evidence	Unknown
		Implicated foodstuff	Human cases			
Denmark	6	1	6	0	1	0
Finland	2	0	2	0	0	0
France	10	0	10	0	0	0
Germany	1	1	1	0	0	0
Netherlands	2	2	1	1	1	0
Poland	3	0	2	0	0	1
Spain	4	0	0	0	0	4
Sweden	1	0	1	0	1	0
EU Total	**29**	**4**	**23**	**1**	**3**	**5**
Norway	6	0	6	0	2	0
Switzerland	1	0	1	0	1	0

Note: countries can report more than one type of evidence per outbreak

The large waterborne outbreak excluded

1. *Campylobacter* spp. is detected in both human cases and implicated foodstuffs followed by speciation and genotyping (e.g. PFGE, AFLP, MLST)

Table CA4. | *Type of verified outbreaks caused by* **Campylobacter**, *2007*

Origin	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
General	16	64.0	165	11	0
Household	7	28.0	22	7	0
Unknown	2	8.0	2	0	0
EU Total	**25**	**100**	**189**	**18**	**0**

Note: Spain (N=4) is not included due to reporting aggregated data

The large waterborne outbreak excluded

Table CA5. | *Implicated foodstuffs in verified outbreaks caused by* **Campylobacter**, *2007*

Implicated foodstuff	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Bovine meat and products thereof	1	4.0	4	0	0
Broiler meat (*Gallus gallus*) and products thereof	10	40.0	58	6	0
Milk	4	16.0	42	1	0
Mixed or buffet meals	1	4.0	0	0	0
Turkey meat and products thereof	1	4.0	5	0	0
Other foods	2	8.0	17	1	0
Unknown	6	24.0	63	10	0
EU Total	**25**	**100**	**189**	**18**	**0**

Note: Spain (N=4) is not included due to reporting aggregated data

The large waterborne outbreak excluded

Table CA6. | *Origin of implicated foodstuffs in verified outbreaks caused by* **Campylobacter**, *2007*

Origin	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Domestic	7	28.0	42	1	0
Imported from outside the EU	1	4.0	11	2	0
Intra community trade	1	4.0	2	0	0
Unknown	16	64.0	134	15	0
EU Total	**25**	**100**	**189**	**18**	**0**

Note: Spain (N=4) is not included due to reporting aggregated data

The large waterborne outbreak excluded

Table CA7. | ***Settings in verified outbreaks caused by* Campylobacter, *2007***

Setting	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Canteen or workplace catering	2	8.0	11	2	0
Household	13	52.0	66	8	0
Restaurant, café, pub, bar, hotel	3	12.0	21	0	0
School, kindergarten	1	4.0	26	1	0
Temporary mass catering (fairs, festivals)	1	4.0	5	0	0
Other setting	4	16.0	60	7	0
Unknown	1	4.0	-	-	-
EU Total	**25**	**100**	**189**	**18**	**0**

Note: Spain (N=4) is not included due to reporting aggregated data

The large waterborne outbreak excluded

Table CA8. | ***Origin of the problem in verified outbreaks caused by* Campylobacter, *2007***

Origin	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Catering services, restaurant	2	8.0	24	0	0
Farm (primary production)	4	16.0	35	1	0
Unknown	19	76.0	130	17	0
EU Total	**25**	**100**	**189**	**18**	**0**

Note: Spain (N=4) is not included due to reporting aggregated data

The large waterborne outbreak excluded

Table CA9. | ***Contributory factors in verified outbreaks caused by* Campylobacter, *2007***

Factor	Number of reportings
Cross-contamination	5
Unprocessed contaminated ingredient	4
Unknown	16
EU Total	**25**

Note: MSs can report more than one contributory factor per outbreak

Spain (N=4) is not included due to reporting aggregated data

The large waterborne outbreak excluded

Pathogenic *Escherichia coli* | 3.4

3.4 | Pathogenic *Escherichia coli*

Most pathogenic *Escherichia coli* strains are characterised by the ability to produce toxins. Human pathogenic *E. coli* usually harbour additional virulence factors that are important for the development of disease in humans. A large number of serotypes of *E. coli* have been recognised as verocytotoxin (VT) producers (verotoxin producing *E. coli* = VTEC). Human VTEC infections are however, associated with a minor number of O:H serotypes. Of these, the VTEC O157 serotype is most frequently reported to be associated with human disease.

The majority of reported human VTEC cases are sporadic. The symptoms associated with VTEC infection in humans vary from mild to bloody diarrhoea, which is often accompanied by abdominal cramps, usually without fever. The incubation period is relatively long, ranging between two to ten days, with a median of three to four days. VTEC infections can result in haemolytic uremic syndrome (HUS). HUS is characterised by acute renal failure, anaemia and lowered platelet counts. Up to 10% of patients infected with VTEC O157 develop HUS and it is the leading cause of acute renal failure in young children.

The infectious dose is low and human infection may be acquired through the consumption of contaminated food or water, by direct transmission from person to person or from contact with carrier animals.

Animals are a reservoir for VTEC, and VTECs (including VTEC O157) have been isolated from many different animal species. The gastrointestinal tract of healthy ruminants seems to be the most important reservoir for VTEC and food of bovine and ovine origin are frequently reported as a source for human VTEC infections. Other important food sources include faecally contaminated vegetables and contaminated water. VTEC causes no symptoms in infected animals.

Pathogenic *E. coli* outbreaks in 2007

Fourteen MSs reported a total of 65 food-borne outbreaks of human pathogenic *E. coli*, which constituted 1.2% of the total number of reported food-borne outbreaks in the EU (Table GE5).

In 2007, France and Germany accounted for 44.6% of pathogenic *E. coli* outbreaks. The overall reporting rate in the EU was 0.02 per population of 100,000, ranging from 0.01 per 100,000 in Poland and Spain to 0.49 per 100,000 in Malta. Norway reported two outbreaks (Table EC1).

The total number of pathogenic *E. coli* outbreaks within the EU increased by 38.3% compared to 2006 (Table EC1). In particular, the total number of pathogenic *E. coli* outbreaks reported by Austria and France in 2007 increased. In 2006 Austria reported only one *E. coli* outbreak and France did not report any pathogenic *E. coli*.

In the EU, 44.6% of the total reported *E. coli* outbreaks were verified. The verified outbreaks were reported primarily by France, which accounted for 41.4% of the outbreaks. The total number of human cases was dominated by France and Slovenia reporting 30.1% and 25.0% of all cases in the EU, respectively (Table EC2). In total, 4.4% of human cases reported by MSs were hospitalised. No case fatalities were reported. MSs reported on average 18.7 human cases per outbreak, and 0.8 hospitalisations per outbreak.

Table EC1. | ***Reported food-borne outbreaks caused by pathogenic* Escherichia coli, *2005-2007***

Country	2007				2006	2005
	N	Reporting rate per 100,000[1]	Verified outbreaks	% Verified outbreaks	N	N
Austria	6	0.07	0	0	1	2
Belgium	2	0.02	1	50.0	1	0
Denmark	3	0.06	3	100	3	1
Finland	-	-	-	-	-	1
France	12	0.02	12	100	-	-
Germany	17	0.02	0	0	13	20
Greece	2	0.02	0	0	-	-
Ireland	3	0.07	1	33.3	4	0
Lithuania	2	0.06	0	0	-	-
Malta	2	0.49	0	0	-	-
Poland	4	0.01	3	75.0	15	13
Portugal	-	-	-	-	2	-
Romania	-	-	-	-	1	-
Slovenia	2	0.10	2	100	-	-
Spain	5	0.01	5	100	2	7
Sweden	3	0.03	2	66.7	1	4
United Kingdom	2	<0.01	0	0	4	4
EU Total	**65**	**0.02**	**29**	**44.6**	**47**	**52**
Norway	2	0.04	2	100	1	0

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Table EC2. | ***Verified food-borne outbreaks caused by pathogenic* Escherichia coli, *2007***

Country	Outbreaks			Human cases				
	N	% of EU total	Reporting rate per 100,000[1]	Cases	Cases/ outbreak	Hospitalisations	Hospitalisations/ outbreak	Deaths
Belgium	1	3.4	0.01	13	13.0	5	5.0	0
Denmark	3	10.3	0.06	71	23.7	0	0	0
France	12	41.4	0.02	163	13.6	11	0.9	0
Ireland	1	3.4	0.02	6	6.0	2	2.0	0
Poland	3	10.3	0.01	16	5.3	5	1.7	0
Slovenia	2	6.9	0.10	135	67.5	1	0.5	0
Spain	5	17.2	0.01	92	18.4	0	0	0
Sweden	2	6.9	0.02	45	22.5	0	0	0
EU Total	**29**	**100**	**0.01**	**541**	**18.7**	**24**	**0.8**	**0**
Norway	2		0.04	6	3.0	1	0.5	0

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Detailed information from verified outbreaks

A total of 29 verified pathogenic *E. coli* outbreaks were reported by MSs. However, detailed information on outbreaks was only available for the 24 outbreaks presented in Tables EC4 to EC9, because Spain reported aggregated data (five outbreaks).

The verification of the outbreak was done through the detection of the causative agent in samples from the human cases and from the implicated foodstuff in 44.8% and 48.3% respectively. The causative agent was laboratory characterised both from the implicated foodstuff and human cases in 3.4% of the outbreaks. Analytical epidemiological evidence was presented in 27.6% of the outbreaks (Table EC3). Several MSs reported more than one type of evidence. One MS did not specify the type of evidence.

Additional information on the type of outbreaks was available for 95.8% of the verified *E. coli* outbreaks. General outbreaks formed 75.0% of the outbreaks and caused 85.1% of the human cases and 75.0% of hospitalisations (Table EC4).

Overall, information on the implicated foodstuff was provided in 83.3% of verified pathogenic *E. coli* outbreaks. The foodstuff group 'tap water, including well water' caused 16.7% of the verified pathogenic *E. coli* outbreaks involving 13.8% of human cases; and 8.1% of these cases were admitted to hospital (Table EC5).

Belgium reported an outbreak with verocytotoxigenic Escherichia coli *(VTEC) O145 and VTEC O26. Infection occurred among consumers of ice cream produced at a local farm. The ice cream was consumed at two birthday parties and at the farm. Five cases (2-11 years of age) developed haemolytic uremic syndrome (HUS), and seven cases suffered from severe diarrhoea. In three of the five HUS cases VTEC O145 infections were laboratory confirmed, one in association with VTEC O26. Identical isolates of VTEC O145 and O26 were detected with Polymerase Chain Reaction (PCR) and PFGE in human samples, ice cream leftovers, faecal samples taken from calves, and in samples of soiled straw from the farm. The ice cream was made from pasteurised milk and most likely contaminated by one of the food handlers.*

The origin of the foodstuff was only reported in 25.0% of all verified pathogenic *E. coli* outbreaks (Table EC6) and 83.3% of these originated from domestically produced foodstuffs.

There was no common setting reported in the verified *E. coli* outbreaks (Table EC7). However, three large outbreaks took place in canteens or workplace catering and resulted in 32.3% of human cases.

The place of origin of the implicated exposure was reported in 33.3% of all verified outbreaks caused by pathogenic *E. coli* (Table EC8). The largest number of human cases (39.4%) originated from outbreaks originating in catering services or restaurants.

In Denmark, an outbreak with verotoxigenic Escherichia coli *(VTEC) O26:H11 occurred with 20 laboratory confirmed cases of which 19 were small children. The outbreak strain was positive for vtx1 and eae, but negative for vtx2. Symptoms of cases were generally quite mild. A comparative study of the shopping lists from affected families obtained from supermarket computer systems of credit card information and a case-control study confirmed the source of the outbreak to be an organic cured beef sausage. The outbreak strain was confirmed microbiologically in both the raw meat and the sausages obtained from private households who had bought the sausage but which had not yet been consumed. The batch of 19,000 sausages was already placed on the market and/or sold, and was recalled. It was believed that the outbreak affected many more people than the cases reported.*

Seven different contributing factors were reported in the *E. coli* outbreaks but no common specific factor could be identified (Table EC9).

Table EC3. | ***Evidence in verified outbreaks, 2007***

Country	N	Causative agent detected in:		Laboratory characterisation of isolates[1]	Analytical epidemiological evidence	Unknown
		Implicated foodstuff	Human cases			
Belgium	1	1	1	0	0	0
Denmark	3	1	3	0	1	0
France	12	5	3	0	6	0
Ireland	1	1	1	0	0	0
Poland	3	2	1	0	1	0
Slovenia	2	2	2	1	0	0
Spain	5	0	0	0	0	5
Sweden	2	2	2	0	0	0
EU Total	**29**	**14**	**13**	**1**	**8**	**5**
Norway	2	0	2	0	0	0

Note: countries can report more than one type of evidence per outbreak

1. Pathogenic *Escherichia coli* is detected in both human cases and implicated foodstuffs followed by complete serotyping (O, H) and typing of virulence genes. For frequent serotypes (e.g. O157) genotyping (PFGE, MLVA) should be carried out as well

Table EC4. | ***Type of verified outbreaks caused by pathogenic* Escherichia coli, *2007***

Type	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
General	18	75.0	382	18	0
Household	5	20.8	62	6	0
Unknown	1	4.2	5	0	0
EU Total	**24**	**100**	**449**	**24**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table EC5. | ***Implicated foodstuffs in verified outbreaks caused by pathogenic* Escherichia coli, *2007***

Implicated foodstuff	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Bovine meat and products thereof	2	8.3	31	0	0
Broiler meat (*Gallus gallus*) and products thereof	2	8.3	60	0	0
Cereal products including rice and seeds/pulses (nuts, almonds)	1	4.2	45	0	0
Cheese	2	8.3	14	1	0
Crustaceans, shellfish, molluscs and products thereof	1	4.2	6	0	0
Dairy products (other than cheeses)	1	4.2	13	5	0
Fish and fish products	1	4.2	7	0	0
Mixed or buffet meals	1	4.2	40	0	0
Other or unspecified poultry meat and products thereof	1	4.2	6	0	0
Tap water, including well water	4	16.7	62	5	0
Other foods	4	16.7	120	13	0
Unknown	4	16.7	45	0	0
EU Total	**24**	**100**	**449**	**24**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table EC6. | ***Origin of implicated foodstuffs in verified outbreaks caused by pathogenic* Escherichia coli, *2007***

Origin	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Domestic	5	20.8	50	9	0
Imported from outside the EU	1	4.2	5	0	0
Unknown	18	75.0	394	15	0
EU Total	**24**	**100**	**449**	**24**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table EC7. | ***Settings in verified outbreaks caused by pathogenic* Escherichia coli, *2007***

Setting	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Canteen or workplace catering	3	12.5	145	0	0
Hospital or medical care facility	1	4.2	15	0	0
Household	8	33.3	86	13	0
Restaurant, café, pub, bar, hotel	6	25.0	101	0	0
School, kindergarten	2	8.3	17	10	0
Other setting	3	12.5	67	1	0
Unknown	1	4.2	18	0	0
EU Total	**24**	**100**	**449**	**24**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table EC8. | ***Origin of the problem in verified outbreaks caused by pathogenic* Escherichia coli, *2007***

Origin	Outbreaks		Human cases		
	N	% of EU total	N	Hospitalisations	Deaths
Catering services, restaurant	3	12.5	177	0	0
Farm (primary production)	2	8.3	18	5	0
Processing plant	1	4.2	18	0	0
Water distribution system	1	4.2	43	1	0
Water source	1	4.2	6	2	0
Unknown	16	66.7	187	16	0
EU Total	**24**	**100**	**449**	**24**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table EC9. | ***Contributory factors in verified outbreaks caused by pathogenic* Escherichia coli, *2007***

Factor	Number of reportings
Cross-contamination	2
Inadequate chilling	1
Infected food handler	1
Storage time/temperature abuse	2
Unprocessed contaminated ingredient	1
Water treatment failure	1
Other contributory factor	4
Unknown	14
EU Total	**26**

Note: MSs can report more than one contributory factor per outbreak

Spain (N=5) is not included due to reporting aggregated data

Yersinia | 3.5

3.5 | *Yersinia*

The bacterial genus *Yersinia* comprises three main species that are known to cause human infections: *Yersinia enterocolitica*, *Y. pseudotuberculosis* and *Y. pestis* (causing plague). The last major human outbreak of *Y. pestis* in Europe took place in 1720, and a smaller one in 1898. Today *Y. pestis* is believed to no longer exist in Europe, whereas *Y. pseudotuberculosis* and specific types of *Y. enterocolitica* cause food-borne enteric infections in humans.

Yersiniosis caused by *Y. enterocolitica* is most often characterised by diarrhoea, at times bloody, and is reported mostly in young children. Symptoms typically develop four to seven days after exposure and may last for one to three weeks (or longer). In older children and adults, right-sided abdominal pain and fever may be the predominant symptoms and is therefore often confused with appendicitis resulting in unnecessary appendectomies. Complications such as a rash, joint pain and/or bacteraemia can occur. Infection is often acquired by eating contaminated food, particularly raw or undercooked pig meat. The ability of the organism to grow at +4°C makes refrigerated food with a relatively long shelf life a probable source of infection. Drinking contaminated unpasteurised milk or untreated water can also transmit the organism. On rare occasions, transmission may occur by direct contact with infected animals or humans.

Yersiniosis caused by *Y. pseudotuberculosis* shows many similarities with the disease pattern of *Y. enterocolitica*. Infections are caused by ingestion of the bacteria from contaminated raw vegetables, fruit or other foodstuffs or by direct contact with infected animals.

Pigs have been considered to be the primary reservoir for the human pathogenic types of *Y. enterocolitica*; however other animal species, e.g. cattle, sheep, deer, small rodents, cats and dogs may also carry pathogenic serotypes. Clinical disease in animals is uncommon.

Yersinia outbreaks in 2007

Seven MSs reported a total of 22 food-borne outbreaks of human yersiniosis, which constituted 0.4% of the total number of reported outbreaks in the EU (Table GE5). In 2007, Germany and Lithuania accounted for 68.2% of *Yersinia* outbreaks. The overall reporting rate was <0.01 per population of 100,000. One non-MS reported two outbreaks (Table YE1).

In the EU, only two *Yersinia enterocolitica* outbreaks were verified (one in Poland and another in Spain). These outbreaks were household ones and caused six human cases and three hospitalisations (Table YE2).

For the Polish outbreak the implicated foodstuff was vegetable juice and no contributory factors were reported.

Regarding the Spanish outbreak the implicated foodstuff was pig meat and inadequate heat treatment and storage time/temperature abuse were listed as contributing factors.

Table YE1. | ***Reported food-borne outbreaks caused by* Yersinia, *2005-2007***

Country	2007				2006	2005
	N	Reporting rate per 100,000[1]	Verified outbreaks	% Verified outbreaks	N	N
Austria	-	-	-	-	4	2
Belgium	1	0.01	0	0	0	0
Denmark	-	-	-	-	0	1
Estonia	2	0.15	0	0	0	0
Finland	-	-	-	-	2	0
Germany	11	0.01	0	0	13	4
Italy	-	-	-	-	1	0
Latvia	1	0.04	0	0	1	0
Lithuania	4	0.12	0	0	1	2
Poland	2	<0.01	1	50.0	0	0
Portugal	-	-	-	-	1	0
Slovenia	-	-	-	-	1	0
Spain	1	<0.01	1	100	0	0
EU Total	**22**	**<0.01**	**2**	**9.1**	**24**	**9**
Norway	2	0.04	2	100	2	0

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Table YE2. | ***Verified food-borne outbreaks caused by* Yersinia, *2007***

Country	Outbreaks			Human cases		
	N	% of EU total	Reporting rate per 100,000[1]	N	Hospitalisations	Deaths
Poland	1	50	<0.01	2	2	0
Spain	1	50	<0.01	4	1	0
EU Total	**1**	**100**	**<0.01**	**6**	**3**	**0**
Norway	2		0.04	9	0	0

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Other bacterial agents | 3.6

3.6 | Other bacterial agents

Numerous other bacteria (e.g. *Listeria*, *Shigella*, *Citrobacter*, *Francisella*, *Enterobacter*, etc.) may cause food-borne outbreaks. The main route of transmission to humans is through consumption of contaminated food and/or water. However, for some of these agents infection can also be transmitted directly from infected animals (e.g. *Francisella tularensis* causing tularaemia) to humans as well as between humans (e.g. *Shigella* infections). Infected animals are commonly asymptomatic carriers and shed the organisms in significant numbers thereby contaminating surroundings. Infected humans may have varying symptoms from mild symptoms and diarrhoea to life threatening infections. *Listeria* infections in humans may have a high case fatality ratio in industrialised countries.

Outbreaks caused by other bacterial agents in 2007

Eight MSs reported a total of 40 food-borne outbreaks caused by other bacterial agents, which constituted 0.7% of the total number of reported outbreaks in the EU (Table GE5). In the EU, 17 of these reported outbreaks were verified. In addition, one non-MS reported five verified outbreaks (Table OBa1). A total of 497 human cases was recorded and the overall hospitalisation rate in the EU was 6.4% (N=32). Denmark reported a large *Shigella sonnei* outbreak accounting for 92.2% of all reported human cases caused by this species (Table OBa2).

Table OBa1. | ***Reported food-borne outbreaks caused by other bacterial agents, 2005-2007***

Country	2007				2006	2005
	N	Reporting rate per 100,000[1]	Verified outbreaks	% Verified outbreaks	N	N
Austria	5	0.06	0	0	3	-
Belgium	-	-	-	-	7	-
Czech Republic	-	-	-	-	1	-
Denmark	1	0.02	1	100	3	-
Finland	1	0.02	1	100	2	-
France	4	<0.01	4	100	4	-
Germany	9	0.01	0	0	8	15
Greece	-	-	-	-	1	1
Ireland	-	-	-	-	-	1
Italy	-	-	-	-	1	-
Latvia	10	0.44	3	30.0	11	12
Lithuania	-	-	-	-	2	3
Poland	-	-	-	-	4	13
Slovakia	5	0.09	3	60.0	-	-
Spain	5	0.01	5	100	5	4
Sweden	-	-	-	-	-	2
EU Total	**40**	**0.01**	**17**	**42.5**	**52**	**51**
Norway	5	0.11	5	100	2	3
Switzerland	-	-	-	-	2	-

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Table OBa2. | ***Verified food-borne outbreaks caused by other bacterial agents, 2007***

Agent	Country	Outbreaks			Human cases		
		N	% of EU total	Reporting rate per 100,000[1]	N	Hospitalisations	Deaths
Enterobacter spp., unspecified	Slovakia	2	100	0.04	74	-	-
	EU Total	**2**	**100**	**0.04**	**74**	**-**	**-**
Citrobacter spp., unspecified	Slovakia	1	100	0.02	47	-	-
	EU Total	**1**	**100**	**0.02**	**47**	**-**	**-**
Shigella boydii	Finland	1	100	0.02	90	-	-
	EU Total	**1**	**100**	**0.02**	**90**	**-**	**-**
Shigella flexneri	France	1	33.3	<0.01	5	3	-
	Spain	2	66.7	<0.01	7	2	-
	EU Total	**3**	**100**	**<0.01**	**12**	**5**	**-**
Shigella sonnei	Denmark	1	25.0	0.02	200	-	-
	France	1	25.0	<0.01	3	2	-
	Spain	2	50.0	<0.01	14	3	-
	EU Total	**4**	**100**	**<0.01**	**217**	**5**	**-**
	Norway	1		0.02	6	-	-
Shigella spp., unspecified	France	2	40.0	<0.01	7	1	-
	Latvia	3	60.0	0.13	24	20	-
	EU Total	**5**	**100**	**<0.01**	**31**	**21**	**-**
Vibrio parahaemolyticus	Spain	1	100	<0.01	26	1	-
	EU Total	**1**	**100**	**<0.01**	**26**	**1**	**-**
Francisella tularensis	Norway	3		0.06	10	-	-
Listeria monocytogenes	Norway	1		0.02	21	21	5

Note: The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Detailed information from verified outbreaks

A total of 17 verified outbreaks caused by other bacterial agents were reported, however detailed information on outbreaks was only available for the 12 outbreaks presented in Tables OBa3 to OBa9. These are presented at the end of this section.

The type of evidence verifying the outbreak was detection of the agent from human cases in 64.7% of the outbreaks and from the implicated foodstuff in 23.5% of the outbreaks. The causative agent was laboratory characterised both from the implicated foodstuff and human cases in 17.6% of the outbreaks, namely, three Slovakian outbreaks caused by *Enterobacter* and *Citrobacter*. Analytical epidemiological evidence was presented in two outbreaks (Table OBa3).

In Norway, an outbreak of listeriosis in two hospitals was reported. The outbreak was caused by a soft cheese produced on a small farm with milk production. The Norwegian Food Safety Authority found a very high number of Listeria monocytogenes *in the cheese as well as in the production facilities. The cheese had been sold to the hospitals and on small markets. In total, 21 people were infected; 19 cases were infected in the hospitals and two cases had bought the cheese at a local market. All cases were hospitalised and five cases died of the infection.*

Information on the type of outbreak was available for all the verified outbreaks. Nine out of the 12 outbreaks were reported as general ones (Table OBa4).

Information on the implicated foodstuffs was provided in eight verified outbreaks. Mixed or buffet meals were the cause in four of these outbreaks (Table OBa5).

The origin of the foodstuff was only reported in five verified outbreaks caused by other bacterial agents (Table OBa6). In two *Shigella* outbreaks the implicated foodstuff was reported to be imported from outside the EU.

Denmark reported a large Shigella sonnei *outbreak with a total of 200 laboratory confirmed cases. A large number of cases were infected via salad buffets in different workplace canteens, which were served by a catering company. A cohort study along with other epidemiological evidence showed that the source of infection was fresh baby corn imported from Thailand. The Thai authorities launched an investigation as well. The implicated contaminated baby corn had also been exported to Australia where cases were reported.*

No specific common setting was indicated in verified outbreaks (Table OBa7). However, two large outbreaks were reported by Denmark (*Shigella sonnei*) and Slovakia (*Enterobacter*). Both outbreaks were observed in a canteen causing approximately half (50.4%) of all human cases. In Latvia, an outbreak of *Shigella* in a school or kindergarten caused 19 cases with a hospital admission rate of 89.5%. No fatalities were reported.

Only in one small *Shigella* outbreak was the place of origin of the problem reported, that being household (Table OBa8).

Potential contributory factors were reported only for three of the verified outbreaks of which two *Shigella* outbreaks reported inadequate heat treatment and storage time/temperature abuse as contributing factors (Table OBa9).

Slovakia reported an outbreak with Enterobacter *in a canteen where 27 people were infected. The implicated foodstuff was a mixed or buffet meal in the canteen. The agent was microbiologically characterised both in the cases and in the implicated food. The canteen had low hygiene standards.*

Table OBa3. | ***Evidence in verified outbreaks, 2007***

Country	N	Causative agent detected in:		Laboratory characterisation of isolates[1]	Analytical epidemiological evidence	Unknown
		Implicated foodstuff	Human cases			
Denmark	1	0	1	0	0	0
Finland	1	0	1	0	1	0
France	4	1	3	0	1	0
Latvia	3	0	3	0	0	0
Slovakia	3	3	3	3	0	0
Spain	5	0	0	0	0	5
EU Total	**17**	**4**	**11**	**3**	**2**	**5**
Norway	5	4	2	1	0	0

Note: countries can report more than one type of evidence per outbreak

1. Causative agent is detected in both human cases and implicated foodstuffs followed by: *Enterobacter* - speciation; *Listeria monocytogenes* - serotyping, genotyping (PFGE); *Shigella* - speciation and biotyping and serotyping; *Vibrio* - biotyping and serotyping, pathogenic factors

Table OBa4. | ***Type of verified outbreaks caused by other bacterial agents, 2007***

Type	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
General	*Citrobacter* spp., unspecified	1	8.3	47	0	0
	Enterobacter spp., unspecified	2	16.7	74	0	0
	Shigella boydii	1	8.3	90	0	0
	Shigella sonnei	1	8.3	200	0	0
	Shigella spp., unspecified	4	33.3	28	18	0
Household	*Shigella flexneri*	1	8.3	5	3	0
	Shigella sonnei	1	8.3	3	2	0
	Shigella spp., unspecified	1	8.3	3	3	0
EU Total		**12**	**100**	**450**	**26**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table OBa5. | ***Implicated foodstuffs in verified outbreaks caused by other bacterial agents, 2007***

Implicated foodstuff	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Bovine meat and products thereof	*Shigella flexneri*	1	8.3	5	3	0
Broiler meat (*Gallus gallus*) and products thereof	*Shigella* spp., unspecified	1	8.3	2	1	0
Crustaceans, shellfish, molluscs and products thereof	*Shigella* spp., unspecified	1	8.3	5	0	0
Mixed or buffet meals	*Citrobacter* spp., unspecified	1	8.3	47	0	0
	Enterobacter spp., unspecified	2	16.7	74	0	0
	Shigella boydii	1	8.3	90	0	0
Vegetables and juices and other products thereof	*Shigella sonnei*	1	8.3	200	0	0
Unknown	*Shigella sonnei*	1	8.3	3	2	0
	Shigella spp., unspecified	3	25.0	24	20	0
EU Total		**12**	**100**	**450**	**26**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table OBa6. | ***Origin of implicated foodstuffs in verified outbreaks caused by other bacterial agents, 2007***

Origin	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Domestic	*Shigella boydii*	1	8.3	90	0	0
	Shigella spp., unspecified	2	16.7	22	20	0
Imported from outside the EU	*Shigella sonnei*	1	8.3	200	0	0
	Shigella spp., unspecified	1	8.3	2	0	0
Unknown	*Enterobacter* spp., unspecified	2	16.7	74	0	0
	Shigella flexneri	1	8.3	5	3	0
	Shigella sonnei	1	8.3	3	2	0
	Shigella spp., unspecified	2	16.7	7	1	0
	Citrobacter spp., unspecified	1	8.3	47	0	0
EU Total		**12**	**100**	**450**	**26**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table OBa7. | ***Settings in verified outbreaks caused by other bacterial agents, 2007***

Setting	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Canteen or workplace catering	*Enterobacter* spp., unspecified	1	8.3	27	0	0
	Shigella sonnei	1	8.3	200	0	0
Household	*Shigella flexneri*	1	8.3	5	3	0
	Shigella sonnei	1	8.3	3	2	0
	Shigella spp., unspecified	1	8.3	3	3	0
Residential institution (nursing home, prison, boarding school)	*Enterobacter* spp., unspecified	1	8.3	47	0	0
Restaurant, café, pub, bar, hotel	*Shigella boydii*	1	8.3	90	0	0
	Shigella spp., unspecified	1	8.3	2	1	0
School, kindergarten	*Shigella* spp., unspecified	1	8.3	19	17	0
Other setting	*Shigella* spp., unspecified	1	8.3	5	0	0
	Citrobacter spp., unspecified	1	8.3	47	0	0
Unknown	*Shigella* spp., unspecified	1	8.3	2	0	0
EU Total		**12**	**100**	**450**	**26**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table OBa8. | ***Origin of the problem in verified outbreaks caused by other bacterial agents, 2007***

Origin	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Household, domestic kitchen	*Shigella* spp., unspecified	1	8.3	3	3	0
Unknown	*Enterobacter* spp., unspecified	2	16.7	74	0	0
	Shigella boydii	1	8.3	90	0	0
	Shigella flexneri	1	8.3	5	3	0
	Shigella sonnei	2	16.7	203	2	0
	Shigella spp., unspecified	4	33.3	28	18	0
	Citrobacter spp., unspecified	1	8.3	47	0	0
EU Total		**12**	**100**	**450**	**26**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table OBa9. | ***Contributory factors in verified outbreaks caused by other bacterial agents, 2007***

Factor	Causative agent	Number of reportings
Inadequate heat treatment	*Shigella* spp., unspecified	1
Storage time/temperature abuse	*Shigella* spp., unspecified	1
Other contributory factor	*Shigella* spp., unspecified	1
Unknown	*Enterobacter* spp., unspecified	2
	Shigella boydii	1
	Shigella flexneri	1
	Shigella sonnei	2
	Shigella spp., unspecified	2
	Citrobacter spp., unspecified	1
EU Total		**12**

Note: MSs can report more than one contributory factor per outbreak

Spain (N=5) is not included due to reporting aggregated data

Bacterial toxins | 3.7

3.7 | Bacterial toxins

Bacterial toxins can cause damage to the host by destroying cells or disrupting normal cellular metabolism. Both Gram negative and Gram positive bacteria produce highly potent toxins.

Staphylococcus aureus produces toxins that cause intense vomiting in humans. *Clostridium* botulinum toxin is the cause of a rare but potentially deadly intoxication and occurs when the anaerobic bacterium grows in foods and produces botulinum toxin, a powerful paralytic toxin.

Clostridium perfringens bacteria multiply especially in food prepared from red meat and poultry and its toxins cause abdominal cramps and diarrhoea. *Bacillus cereus* may produce emetic and diarrheagenic toxins. Depending on the type of toxin, *Bacillus cereus* may cause severe nausea, vomiting and watery diarrhoea.

Most bacterial toxins can be destroyed by heating. However, exceptions include certain staphylococcal enterotoxins. Further, the emetic toxin of *Bacillus cereus* has high heat tolerance and cannot be destroyed by normal heat treatment.

Outbreaks caused by bacterial toxins in 2007

Ten MSs reported a total of 105 food-borne outbreaks caused by *Bacillus* spp. and 97.1% of these were verified. In addition, one non-MS reported five *Bacillus* spp. outbreaks. The total number of outbreaks caused by *Bacillus* spp. toxins within the EU has increased by 41.9% when compared to 2006.

Thirteen MSs reported 95 food-borne outbreaks caused by *Clostridium* spp. and 95.8% of these were verified. Also, one non-Ms reported five *Clostridium* outbreaks.

Sixteen MSs reported 258 food-borne outbreaks caused by *Staphylococcus* spp., which constituted 4.6% of the total number of reported outbreaks in the EU and 90.7% of which were verified. Two non-MSs reported eight *Staphylococcus* spp. outbreaks.

The overall reporting rate of outbreaks caused by bacterial toxins in the EU ranged from 0.02 to 0.06 per population of 100,000 (Table BaT1).

In the EU, 93.2% of reported outbreaks caused by bacterial toxins were verified. The vast majority of the verified outbreaks were, however, almost exclusively reported by France (Table BaT2). In total, there were 6,277 human cases accounting for 15.8% of the total number of human cases reported in the EU. The two highest hospitalisation rates for verified outbreaks caused by bacterial toxins were 84.8% for *Clostridium botulinum* and 10.5% for *Staphylococcus aureus*. There were four deaths due to *Staphylococcus*.

Four MSs reported together 16 verified outbreaks caused by *Clostridium botulinum*. A total of 33 cases was recorded of which 28 were hospitalised, but no deaths were reported.

Table BaT1. | ***Reported food-borne outbreaks caused by bacterial toxins, 2005-2007***

Agent	2007					2006	2005
	Country	N	Reporting rate per 100,000[1]	Verified outbreaks	% Verified outbreaks	N	N
Bacillus	Belgium	7	0.07	7	100	6	1
	Denmark	2	0.04	2	100	3	3
	Finland	-	-	-	-	4	5
	France	69	0.11	69	100	50	0
	Germany	5	0.01	5	100	1	0
	Hungary	2	0.02	0	0	-	-
	Italy	-	-	-	-	2	-
	Malta	1	0.25	0	0	-	-
	Netherlands	12	0.07	12	100	2	0
	Poland	1	<0.01	1	100	1	3
	Portugal	-	-	-	-	2	0
	Romania	-	-	-	-	2	0
	Slovakia	1	0.02	1	100	0	0
	Spain	5	0.01	5	100	0	0
	Sweden	-	-	-	-	1	1
	EU Total	**105**	**0.03**	**102**	**97.1**	**74**	**13**
	Norway	5	0.11	1	20.0	5	5
Clostridium	Austria	-	-	-	-	1	0
	Czech Republic	1	0.01	1	100	0	0
	Denmark	6	0.11	6	100	6	5
	Finland	2	0.04	2	100	1	2
	France	54	0.09	54	100	42	0
	Germany	3	<0.01	3	100	0	2
	Hungary	1	0.01	1	100	9	0
	Italy	-	-	-	-	2	-
	Latvia	1	0.04	0	0	0	0
	Netherlands	2	0.01	2	100	0	0
	Poland	8	0.02	8	100	5	3
	Portugal	-	-	-	-	5	-
	Romania	5	0.02	5	100	4	0
	Spain	9	0.02	9	100	0	0
	Sweden	1	0.01	0	0	1	5
	United Kingdom	2	<0.01	0	0	6	9
	EU Total	**95**	**0.02**	**91**	**95.8**	**82**	**26**
	Norway	5	0.11	3	60.0	0	1

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Table BaT1. | ***Reported food-borne outbreaks caused by bacterial toxins, 2005-2007 (contd.)***

Agent	2007					2006	2005
	Country	N	Reporting rate per 100,000[1]	Verified outbreaks	% Verified outbreaks	N	N
Staphylococcus	Austria	1	0.01	1	100	2	0
	Belgium	5	0.05	5	100	7	4
	Czech Republic	1	0.01	0	0	0	0
	Denmark	1	0.02	1	100	0	0
	Finland	1	0.02	1	100	1	1
	France	178	0.28	178	100	169	0
	Germany	-	-	-	-	4	-
	Hungary	1	0.01	1	100	1	0
	Italy	-	-	-	-	5	6
	Latvia	9	0.39	1	11.1	8	2
	Lithuania	3	0.09	0	0	3	0
	Malta	1	0.25	0	0	0	0
	Netherlands	11	0.07	10	90.9	0	0
	Poland	11	0.03	4	36.4	17	18
	Portugal	-	-	-	-	2	1
	Romania	10	0.05	10	100	9	0
	Slovakia	7	0.13	5	71.4	0	0
	Slovenia	-	-	-	-	3	0
	Spain	17	0.04	17	100	0	0
	Sweden	1	0.01	0	0	8	4
	United Kingdom	-	-	-	-	1	0
	EU Total	**258**	**0.06**	**234**	**90.7**	**240**	**36**
	Norway	6	0.13	2	33.3	1	1
	Switzerland	2	0.03	2	100	1	0

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Table BaT2. | ***Verified food-borne outbreaks caused by bacterial toxins, 2007***

Agent	Country	Outbreaks			Human cases		
		N	% of EU total	Reporting rate per 100,000[1]	N	Hospitalisations	Deaths
Bacillus cereus	Belgium	7	6.9	0.07	62	0	0
	Denmark	2	2.0	0.04	6	0	0
	France	69	67.6	0.11	787	28	0
	Germany	5	4.9	0.01	74	0	0
	Netherlands	12	11.8	0.07	44	0	0
	Poland	1	1.0	<0.01	22	1	0
	Slovakia	1	1.0	0.02	14	0	0
	Spain	5	4.9	0.01	53	0	0
	EU Total	**102**	**100**	**0.02**	**1,062**	**29**	**0**
	Norway	1		0.02	70	0	0
Clostridium botulinum	France	1	6.3	<0.01	4	2	0
	Germany	2	12.5	<0.01	5	3	0
	Poland	8	50.0	0.02	18	17	0
	Romania	5	31.3	0.02	6	6	0
	EU Total	**16**	**100**	**0.01**	**33**	**28**	**0**
Clostridium perfringens	Czech Republic	1	1.3	0.01	40	1	0
	Denmark	6	8.0	0.11	168	0	0
	Finland	2	2.7	0.04	16	0	0
	France	53	70.7	0.08	1,394	14	0
	Germany	1	1.3	<0.01	37	0	0
	Hungary	1	1.3	0.01	24	0	0
	Netherlands	2	2.7	0.01	202	0	0
	Spain	9	12.0	0.02	573	1	0
	EU Total	**75**	**100**	**0.02**	**2,454**	**16**	**0**
	Norway	3		0.06	47	0	0
Staphylococcus aureus	Austria	1	0.5	0.01	166	2	0
	Belgium	5	2.7	0.05	69	5	0
	Denmark	1	0.5	0.02	6	0	0
	Finland	1	0.5	0.02	13	1	0
	France	131	72.0	0.21	1,361	109	3
	Latvia	1	0.5	0.04	3	3	0
	Netherlands	10	5.5	0.06	57	0	0
	Poland	4	2.2	0.01	59	9	0
	Romania	10	5.5	0.05	66	62	0
	Slovakia	5	2.7	0.09	186	14	0
	Spain	14	7.7	0.03	125	1	0
	EU Total	**182**	**100**	**0.04**	**1,945**	**204**	**3**
	Norway	2		0.04	21	0	0
	Switzerland	2		0.03	18	10	0
Staphylococcus spp., unspecified	France	47	90.4	0.07	470	58	0
	Hungary	1	1.9	0.01	120	8	1
	Spain	3	5.8	0.01	27	0	0
	EU Total	**52**	**100**	**0.01**	**783**	**68**	**1**

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Detailed information from verified outbreaks

A total of 427 verified outbreaks due to bacterial toxins were reported by MSs. However, detailed information on outbreaks was only available for the 396 outbreaks presented in Tables BaT4 to BaT9, because Spain reported aggregated data (31 outbreaks). Data from Spain had sufficient information to be included in the presentation of evidence in verified outbreaks (Table BaT3). All tables with detailed information on verified outbreaks caused by bacterial toxins are presented at the end of this section.

The type of evidence verifying the outbreak was detection from the human cases in 10.5% of outbreaks and from the implicated foodstuff in 34.9% of outbreaks. The causative agent was laboratory characterised both from the implicated foodstuff and human cases in 1.6% of outbreaks. Analytical epidemiological evidence was presented in 55.5% of outbreaks (Table BaT3). Several MSs reported more than one type of evidence. One MS did not specify the type of evidence.

Information on the type of outbreak was available for 94.7% of verified outbreaks. General outbreaks accounted for 65.9% of the outbreaks, causing 78.2% of human cases: of which 5.0% were hospitalised and three cases were fatal (of the total four deaths associated with verified outbreaks due to bacterial toxins) (Table BaT4). In total, 145 *Staphylococcus* outbreaks were reported as general outbreaks.

Overall, information on implicated foodstuffs was provided in 74.7% of the verified bacterial toxin outbreaks (Table BaT5). Eighteen different implicated foodstuffs were reported. Two deaths were reported after consumption of bovine meat and products thereof, and one death was reported after consumption of cereal products, all linked to *S. aureus* outbreaks.

The origin of the foodstuff was only reported in 10.9% of all verified bacterial toxin outbreaks and 90.7% of all reported outbreaks originated from domestically produced foodstuffs (Table BaT6).

The majority of reported settings in verified outbreaks were household (28.8%) and restaurants (29.0%) (Table BaT7). Two fatalities were recorded in medical care facilities, and one, caused by *Staphylococcus*, in relation to take-away facilities.

Belgium reported a Staphylococcus aureus *outbreak from frozen hamburgers at a summer camp. At least 15 children and adults had severe symptoms of nausea, vomiting and diarrhoea shortly after eating lunch. All leftovers of the suspected food (milk, hamburgers, cheese, ketchup and pasta) were sampled by the Belgian Food Agency, as well as hamburgers of the same production date sampled at the supermarket. The hamburgers were produced in the Netherlands and the Dutch authorities performed an inspection at the production plant. An extensive review of production and handling procedures and laboratory testing of different lots from the production plant were performed. All* Staphylococcus aureus *isolates from the food and the production plant were subjected to further molecular typing (Pulsed Field Gel Electrophoresis (PFGE), Multi Locus Sequence Typing (MLST)). The hamburgers served at the camp were contaminated with high levels of* Staphylococcus aureus*, and tested positive for* Staphylococcus aureus *enterotoxin type A. The hamburgers sampled at the supermarket as well as hamburgers sampled at the production plant contained varying levels of* Staphylococcus aureus*, but no enterotoxins could be detected in those samples. All isolates from the food and production plant belonged to the same PFGE type indicating a common source of contamination. The Dutch inspection revealed that the cooling system used to rapidly cool the cooked hamburgers was contaminated with* Staphylococcus aureus *and may not have been properly cleaned.*

The place of origin of the problem was reported for only 9.8% of all verified outbreaks caused by bacterial toxins (Table BaT8).

Storage time/temperature was the most common contributory factor, reported in 60 verified outbreaks. In 29 *Staphylococcus* outbreaks, an infected food handler was reported as the contributory factor (Table BaT9).

In Austria, an outbreak with Staphylococcus aureus *enterotoxin affected 166 people at a school/ kindergarten and led to two cases being hospitalised. Both analytical epidemiological evidence and laboratory detection of the implicated foodstuff confirmed milk as the source of infection. Unprocessed contaminated ingredients were a contributing factor.*

In France, an outbreak with Bacillus cereus *in a school / kindergarten infected 146 people. The implicated foodstuff was confirmed to be herbs and spices by analytical epidemiological evidence and by laboratory detection of the implicated foodstuff.*

Table BaT3. | ***Evidence in verified outbreaks, 2007***

Country	N	Causative agent detected in:		Laboratory characterisation of isolates [1]	Analytical epidemiological evidence	Unknown
		Implicated foodstuff	Human cases			
Austria	1	1	0	0	1	0
Belgium	12	11	1	0	0	0
Czech Republic	1	0	0	0	0	1
Denmark	9	8	0	0	0	1
Finland	3	2	0	0	0	1
France	301	74	10	0	231	0
Germany	8	8	6	0	0	0
Hungary	2	2	2	1	0	0
Latvia	1	0	1	0	0	0
Netherlands	24	24	1	0	3	0
Poland	13	4	11	0	2	0
Romania	15	7	7	0	0	1
Slovakia	6	6	6	6	0	0
Spain	31	2	0	0	0	29
EU Total	**427**	**149**	**45**	**7**	**237**	**33**
Norway	6	6	0	0	0	0
Switzerland	2	2	1	0	0	0

Note: countries can report more than one type of evidence per outbreak

1. Causative agent is detected in both human cases and implicated foodstuffs followed by toxin determination

Table BaT4. | ***Type of verified outbreaks caused by bacterial toxins, 2007***

Type	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
General	*Bacillus cereus*	65	16.4	859	20	0
	Clostridium perfringens	51	12.9	1,574	13	0
	Staphylococcus aureus	108	27.3	1,352	124	2
	Staphylococcus spp., unspecified	37	9.3	517	58	1
Household	*Bacillus cereus*	21	5.3	121	9	0
	Clostridium botulinum	16	4.0	33	28	0
	Clostridium perfringens	14	3.5	305	2	0
	Staphylococcus aureus	52	13.1	602	81	1
	Staphylococcus spp., unspecified	11	2.8	73	8	0
Unknown	*Bacillus cereus*	11	2.8	29	0	0
	Clostridium perfringens	1	0.3	2	0	0
	Staphylococcus aureus	9	2.3	32	0	0
EU Total		**396**	**100**	**5,499**	**343**	**4**

Note: Spain (N=31) is not included due to reporting aggregated data

Table BaT5. | ***Implicated foodstuffs in verified outbreaks caused by bacterial toxins, 2007***

Implicated foodstuff	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Bakery products	*Staphylococcus aureus*	3	0.8	34	0	0
Bovine meat and products thereof	*Bacillus cereus*	2	0.5	10	0	0
	Clostridium perfringens	11	2.8	253	1	0
	Staphylococcus aureus	6	1.5	34	6	2
	Staphylococcus spp., unspecified	5	1.3	31	1	0
Broiler meat (*Gallus gallus*) and products thereof	*Clostridium perfringens*	8	2.0	194	0	0
	Staphylococcus aureus	9	2.3	47	6	0
	Staphylococcus spp., unspecified	3	0.8	14	1	0
Cereal products including rice and seeds/pulses (nuts, almonds)	*Bacillus cereus*	5	1.3	62	0	0
	Staphylococcus aureus	7	1.8	26	6	0
	Staphylococcus spp., unspecified	1	0.3	120	8	1
Cheese	*Bacillus cereus*	2	0.5	12	0	0
	Staphylococcus aureus	15	3.8	90	54	0
	Staphylococcus spp., unspecified	2	0.5	8	4	0
Crustaceans, shell-fish, molluscs and products thereof	*Bacillus cereus*	3	0.8	36	2	0
Dairy products (other than cheeses)	*Bacillus cereus*	1	0.3	3	0	0
	Staphylococcus aureus	2	0.5	9	9	0
Drinks, including bottled water	*Staphylococcus* spp., unspecified	2	0.5	25	9	0

Table BaT5. | ***Implicated foodstuffs in verified outbreaks caused by bacterial toxins, 2007 (contd.)***

Implicated foodstuff	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Eggs and egg products	*Bacillus cereus*	1	0.3	4	0	0
	Clostridium perfringens	1	0.3	25	0	0
	Staphylococcus aureus	5	1.3	19	0	0
	Staphylococcus spp., unspecified	3	0.8	60	0	0
Fish and fish products	*Bacillus cereus*	3	0.8	32	0	0
	Clostridium botulinum	2	0.5	3	3	0
	Clostridium perfringens	2	0.5	30	0	0
	Staphylococcus aureus	4	1.0	10	0	0
	Staphylococcus spp., unspecified	5	1.3	31	0	0
Herbs and spices	*Bacillus cereus*	2	0.5	149	0	0
	Clostridium perfringens	1	0.3	19	0	0
Milk	*Bacillus cereus*	1	0.3	8	0	0
	Staphylococcus aureus	4	1.0	185	5	0
Mixed or buffet meals	*Bacillus cereus*	10	2.5	77	0	0
	Clostridium botulinum	1	0.3	2	2	0
	Clostridium perfringens	9	2.3	343	1	0
	Staphylococcus aureus	12	3.0	221	32	0
Other or mixed red meat and products thereof	*Bacillus cereus*	2	0.5	5	0	0
	Clostridium botulinum	2	0.5	4	4	0
	Clostridium perfringens	1	0.3	14	0	0
	Staphylococcus aureus	4	1.0	69	3	0
Other or unspecified poultry meat and products thereof	*Bacillus cereus*	3	0.8	12	1	0
	Staphylococcus aureus	2	0.5	6	1	0
	Staphylococcus spp., unspecified	1	0.3	6	0	0
Pig meat and products thereof	*Bacillus cereus*	2	0.5	9	0	0
	Clostridium botulinum	11	2.8	24	19	0
	Clostridium perfringens	5	1.3	38	1	0
	Staphylococcus aureus	6	1.5	34	4	0
	Staphylococcus spp., unspecified	2	0.5	58	23	0
Sheep meat and products thereof	*Bacillus cereus*	2	0.5	16	0	0
	Staphylococcus aureus	2	0.5	15	3	0
Turkey meat and products thereof	*Bacillus cereus*	1	0.3	41	0	0
	Clostridium perfringens	1	0.3	24	0	0
Other foods	*Bacillus cereus*	29	7.3	230	23	0
	Clostridium perfringens	18	4.5	729	12	0
	Staphylococcus aureus	37	9.3	783	54	0
	Staphylococcus spp., unspecified	12	3.0	165	17	0

Table BaT5. | ***Implicated foodstuffs in verified outbreaks caused by bacterial toxins, 2007 (contd.)***

Implicated foodstuff	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Unknown	*Bacillus cereus*	28	7.1	303	3	0
	Bacillus spp., unspecified	0	0	0	0	0
	Clostridium perfringens	9	2.3	212	0	0
	Clostridium spp., unspecified	0	0	0	0	0
	Staphylococcus aureus	51	12.9	404	22	1
	Staphylococcus spp., unspecified	12	3.0	72	3	0
EU Total		**396**	**100**	**5,499**	**343**	**4**

Note: Spain (N=31) is not included due to reporting aggregated data

Table BaT6. | ***Origin of implicated foodstuffs in verified outbreaks caused by bacterial toxins, 2007***

Origin	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Domestic	*Bacillus cereus*	2	0.5	24	1	0
	Clostridium botulinum	12	3.0	23	22	0
	Clostridium perfringens	3	0.8	40	0	0
	Staphylococcus aureus	21	5.3	372	62	0
	Staphylococcus spp., unspecified	1	0.3	120	8	1
Imported from outside the EU	*Clostridium botulinum*	1	0.3	1	1	0
Intra community trade	*Staphylococcus aureus*	3	0.8	34	20	0
Unknown	*Bacillus cereus*	95	24.0	985	28	0
	Bacillus spp., unspecified	0	0	0	0	0
	Clostridium botulinum	3	0.8	9	5	0
	Clostridium perfringens	63	15.9	1,841	15	0
	Clostridium spp., unspecified	0	0	0	0	0
	Staphylococcus aureus	145	36.6	1,580	123	3
	Staphylococcus spp., unspecified	47	11.9	470	58	0
EU Total		**396**	**100**	**5,499**	**343**	**4**

Note: Spain (N=31) is not included due to reporting aggregated data

Table BaT7. | ***Settings in verified outbreaks caused by bacterial toxins, 2007***

Setting	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Camp, picnic	*Bacillus cereus*	2	0.5	18	0	0
	Staphylococcus aureus	1	0.3	15	1	0
Canteen or workplace catering	*Bacillus cereus*	8	2.0	116	0	0
	Clostridium perfringens	10	2.5	201	1	0
	Staphylococcus aureus	8	2.0	114	8	0
Hospital or medical care facility	*Bacillus cereus*	7	1.8	74	0	0
	Clostridium perfringens	12	3.0	260	1	0
	Staphylococcus aureus	9	2.3	92	5	2
	Staphylococcus spp., unspecified	1	0.3	3	0	0
Household	*Bacillus cereus*	20	5.1	120	9	0
	Clostridium botulinum	15	3.8	32	27	0
	Clostridium perfringens	14	3.5	314	2	0
	Staphylococcus aureus	54	13.6	619	98	1
	Staphylococcus spp., unspecified	11	2.8	73	8	0
Mobile retailer, market/street vendor	*Staphylococcus aureus*	1	0.3	5	5	0
Residential institution (nursing home, prison, boarding school)	*Bacillus cereus*	2	0.5	73	1	0
	Clostridium perfringens	1	0.3	24	0	0
	Staphylococcus aureus	1	0.3	5	5	0
Restaurant, café, pub, bar, hotel	*Bacillus cereus*	30	7.6	134	5	0
	Clostridium perfringens	18	4.5	450	1	0
	Staphylococcus aureus	53	13.4	219	23	0
	Staphylococcus spp., unspecified	14	3.5	66	17	0
School, kindergarten	*Bacillus cereus*	10	2.5	267	0	0
	Clostridium perfringens	2	0.5	42	0	0
	Staphylococcus aureus	26	6.6	739	22	0
	Staphylococcus spp., unspecified	7	1.8	141	8	0
Take-away or fast-food outlet	*Bacillus cereus*	7	1.8	31	0	0
	Clostridium botulinum	1	0.3	1	1	0
	Clostridium perfringens	1	0.3	10	0	0
	Staphylococcus aureus	4	1.0	20	7	0
	Staphylococcus spp., unspecified	1	0.3	120	8	1
Other setting	*Bacillus cereus*	11	2.8	176	14	0
	Clostridium perfringens	7	1.8	540	9	0
	Staphylococcus aureus	11	2.8	155	31	0
	Staphylococcus spp., unspecified	14	3.5	187	25	0
Unknown	*Bacillus* spp., unspecified	0	0	0	0	0
	Clostridium perfringens	1	0.3	40	1	0
	Clostridium spp., unspecified	0	0	0	0	0
	Staphylococcus aureus	1	0.3	3	0	0
	Staphylococcus spp., unspecified	0	0	0	0	0
EU Total		**396**	**100**	**5,499**	**343**	**4**

Note: Spain (N=31) is not included due to reporting aggregated data

Table BaT8. | ***Origin of the problem in verified outbreaks caused by bacterial toxins, 2007***

Origin	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Catering services, restaurant	*Bacillus cereus*	4	1.0	36	0	0
	Clostridium perfringens	6	1.5	268	0	0
	Staphylococcus aureus	7	1.8	66	15	0
	Staphylococcus spp., unspecified	1	0.3	120	8	1
Farm (primary production)	*Staphylococcus aureus*	1	0.3	166	2	0
Household, domestic kitchen	*Bacillus cereus*	1	0.3	3	0	0
	Clostridium botulinum	4	1.0	5	5	0
	Staphylococcus aureus	10	2.5	48	44	0
Other place of origin	*Staphylococcus aureus*	1	0.3	10	6	0
Processing plant	*Clostridium botulinum*	1	0.3	1	1	0
	Staphylococcus aureus	2	0.5	32	1	0
Retail sale outlet	*Staphylococcus aureus*	1	0.3	5	5	0
Unknown	*Bacillus cereus*	92	23.2	970	29	0
	Bacillus spp., unspecified	0	0	0	0	0
	Clostridium botulinum	11	2.8	27	22	0
	Clostridium perfringens	60	15.2	1,613	15	0
	Clostridium spp., unspecified	0	0	0	0	0
	Staphylococcus aureus	147	37.1	1,659	132	3
	Staphylococcus spp., unspecified	47	11.9	470	58	0
EU Total		**396**	**100**	**5,499**	**343**	**4**

Note: Spain (N=31) is not included due to reporting aggregated data

Table BaT9. | ***Contributory factors in verified outbreaks caused by bacterial toxins, 2007***

Factor	Causative agent	Number of reportings
Cross-contamination	*Bacillus cereus*	2
	Clostridium perfringens	3
Inadequate chilling	*Staphylococcus aureus*	2
	Clostridium botulinum	3
	Clostridium perfringens	1
	Staphylococcus aureus	1
Infected food handler	*Staphylococcus aureus*	7
	Staphylococcus spp., unspecified	22
Inadequate heat treatment	*Bacillus cereus*	6
	Clostridium botulinum	5
	Clostridium perfringens	4
	Staphylococcus aureus	5
Storage time/temperature abuse	*Bacillus cereus*	10
	Clostridium botulinum	3
	Clostridium perfringens	15
	Staphylococcus aureus	16
	Staphylococcus spp., unspecified	16
Unprocessed contaminated ingredient	*Bacillus cereus*	2
	Clostridium botulinum	1
	Staphylococcus aureus	6
	Staphylococcus spp., unspecified	5
Other contributory factor	*Bacillus cereus*	11
	Clostridium perfringens	5
	Staphylococcus aureus	9
	Staphylococcus spp., unspecified	1
Unknown	*Bacillus cereus*	72
	Clostridium botulinum	4
	Clostridium perfringens	43
	Staphylococcus aureus	124
	Staphylococcus spp., unspecified	15
EU Total		**419**

Note: MSs can report more than one contributory factor per outbreak

Spain (N=31) is not included due to reporting aggregated data

Viruses | 3.8

3.8 | Viruses

Viral infections account for up to one third of cases of food-borne infections in developed countries. Food-borne viral infections are usually of intermediate (one to three days) incubation period, causing illnesses which are self-limited in otherwise healthy individuals. Since most viruses are host specific, food-borne outbreaks caused by viruses are primarily a result of direct or indirect human contamination of the foodstuffs.

Calicivirus (including norovirus) causes approximately 90% of epidemic non-bacterial outbreaks of gastroenteritis around the world and is responsible for many food-borne outbreaks of gastroenteritis. Norovirus affects people of all ages. The virus is transmitted by food or water contaminated with faeces and by person-to-person contact. Outbreaks of norovirus disease often occur in closed or semi-closed communities, such as long-term care facilities, hospitals, prisons, dormitories, and cruise ships where once the virus has been introduced, the infection spreads very rapidly by either person-to-person transmission or through contaminated food. Many norovirus outbreaks have been traced to food that was handled by one infected person.

Rotavirus is the leading, single cause of severe diarrhoea among infants and young children. Rotavirus is transmitted by the faecal-oral route. It infects cells that line the small intestine and produces an enterotoxin, which induces gastroenteritis, leading to severe diarrhoea and sometimes death through dehydration. Although rotavirus accounts for up to 50% of hospitalisations for severe diarrhoea in infants and children, its importance is still not widely recognised within the public health community, particularly in low-income countries.

The hepatitis A virus is distinguished from other viral agents by its prolonged (two to six week) incubation period and its ability to spread beyond the stomach and intestines, into the liver. It often induces jaundice, or yellowing of the skin, and rarely leads to chronic liver dysfunction. The virus has often been associated with the consumption of contaminated fresh-cut vegetables and fruit.

Outbreaks caused by viruses in 2007

Eighteen MSs reported a total of 668 food-borne outbreaks caused by viruses. Calicivirus (including norovirus) caused 507 outbreaks, rotavirus 122 outbreaks and hepatitis A virus 46 outbreaks. Viral outbreaks constituted 11.9% of the total number of reported outbreaks in the EU (Table GE5).

In 2007, Germany and Latvia accounted for 72.2% of the calicivirus (including norovirus) outbreaks. All reported outbreaks from rotavirus were reported by Latvia. The overall reporting rate in the EU was 0.16 outbreaks per population of 100,000, ranging from <0.01 per 100,000 in the United Kingdom to 5.35 per population of 100,000 in Latvia. A non-MS, Norway, reported 14 outbreaks (Table VI1).

The total number of food-borne outbreaks caused by viruses within the EU has increased by 15.8% compared to 2006 (Table VI1). This is the case especially for the number of outbreaks reported by Germany.

In the EU, 16.6% of the reported viral outbreaks were verified (Table VI2). Denmark and France accounted for 27.5% and 26.3% of the verified calicivirus (including norovirus) outbreaks, respectively. However, Sweden had the highest proportion of human cases in the virus outbreaks (25.9%) followed by Denmark and France, who reported 24.9% and 15.9% of the total human cases caused by calicivirus (including norovirus), respectively. In the EU, the hospitalisation rate of cases was 2.7%.

MSs reported on average 34.1 human cases per outbreak, varying from 3.0 to 174.6 cases, and on average 1.2 hospitalisations per outbreak.

Table VI1. | ***Reported food-borne outbreaks caused by viruses, 2005-2007***

Country	2007				2006	2005
	N	Reporting rate per 100,000[1]	Verified outbreaks	% Verified outbreaks	N	N
Austria	11	0.13	1	9.1	6	1
Belgium	10	0.09	5	50.0	4	-
Czech Republic	2	0.02	0	0	-	-
Denmark	23	0.42	23	100	18	12
Estonia	-	-	-	-	4	3
Finland	6	0.11	6	100	13	16
France	46	0.07	46	100	71	-
Germany	244	0.30	1	0.4	165	129
Greece	7	0.06	0	0	3	3
Hungary	5	0.05	1	20.0	10	-
Ireland	-	-	-	-	3	1
Italy	-	-	-	-	10	-
Latvia	122	5.35	2	1.6	160	33
Lithuania	43	1.27	0	0	-	-
Luxembourg	-	-	-	-	-	-
Malta	2	0.49	0	0	-	-
Netherlands	8	0.05	8	100	11	3
Poland	67	0.18	0	0	34	15
Portugal	-	-	-	-	-	-
Romania	-	-	-	-	-	-
Slovakia	37	0.69	0	0	2	-
Slovenia	-	-	-	-	28	34
Spain	13	0.03	13	100	-	-
Sweden	19	0.21	5	26.3	31	14
United Kingdom	3	<0.01	0	0	4	4
EU Total	**668**	**0.16**	**111**	**16.6**	**577**	**268**
Norway	14	0.30	2	14.3	17	11

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Table VI2. | ***Verified food-borne outbreaks caused by viruses, 2007***

Agent	Country	Outbreaks			Human cases				
		N	% of EU total	Reporting rate per 100,000[1]	Cases	Cases/ outbreak	Hospitali-sations	Hospitalisations/ outbreak	Deaths
Calicivirus (including norovirus)	Austria	1	1.3	0.01	21	21.0	0	0.0	0
	Belgium	5	6.3	0.05	229	45.8	1	0.2	0
	Denmark	22	27.5	0.40	837	38.0	0	0.0	0
	Finland	6	7.5	0.11	215	35.8	2	0.3	0
	France	21	26.3	0.03	535	25.5	20	1.0	0
	Germany	1	1.3	<0.01	18	18.0	1	1.0	0
	Latvia	1	1.3	0.04	7	7.0	7	7.0	0
	Netherlands	8	10.0	0.05	206	25.8	37	4.6	0
	Spain	10	12.5	0.02	424	42.4	23	2.3	0
	Sweden	5	6.3	0.05	873	174.6	-	-	-
	EU Total	**80**	**100**	**0.03**	**3,365**	**42.1**	**91**	**1.1**	**0**
	Norway	2		0.04	19	9.5	0	0.0	0
TBE virus	Hungary	1	100	0.01	27	27.0	23	23.0	0
	EU Total	**1**	**100**	**0.01**	**27**	**27.0**	**23**	**23.0**	**0**
Hepatitis A virus	France	2	50	<0.01	9	4.5	0	0.0	0
	Spain	2	50	<0.01	6	3.0	-	-	-
	EU Total	**4**	**100**	**<0.01**	**15**	**3.8**	**0**	**0.0**	**0**
Rotavirus	Latvia	1	50	0.04	3	3.0	3	3.0	0
	Spain	1	50	<0.01	10	10.0	-	-	-
	EU Total	**2**	**100**	**0.04**	**13**	**6.5**	**3**	**1.5**	**0**
Virus not specified	Denmark	1	4.2	0.02	32	32.0	0	0.0	0
	France	23	95.8	0.04	332	14.4	14	0.6	0
	EU Total	**24**	**100**	**0.01**	**364**	**15.2**	**14**	**0.6**	**0**

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Detailed information from verified outbreaks

A total of 111 verified food-borne virus outbreaks were reported by MSs. However, detailed information on outbreaks was only available for the 98 outbreaks presented in Tables VI4 to VI9, because Spain reported aggregated data (13 outbreaks). All tables with detailed information on outbreaks caused by viruses are presented at the end of this section.

The type of evidence verifying the outbreak was detection of the agent in human cases in 44.1% of outbreaks and in implicated foodstuffs in 15.3% of the outbreaks. The causative agent was laboratory characterised both from the implicated foodstuff and human cases in one outbreak. Analytical epidemiological evidence was presented in 38.7% of the outbreaks (Table VI3). Several MSs reported more than one type of evidence.

Information on the type of outbreak was available for all verified virus outbreaks. General outbreaks were recorded in 86.7% of the cases. The general outbreaks caused, on average, a higher number of human cases than household outbreaks (on average 37 human cases per verified outbreak), and 97.2% of all hospitalisations were caused by general outbreaks (Table VI4). Calicivirus (including norovirus) caused 74.1% of all general outbreaks.

Overall, information on the implicated foodstuff was provided in 66.3% of the verified virus outbreaks (Table VI5). As in previous years, crustaceans, shellfish, molluscs and products thereof, and buffet meals were the foodstuffs most frequently associated with virus outbreaks caused by calicivirus (including norovirus) (Figure VI1). The origin of the foodstuff was only reported in 14.3% of verified outbreaks caused by viruses and all originated from domestically produced foodstuffs (Table VI6).

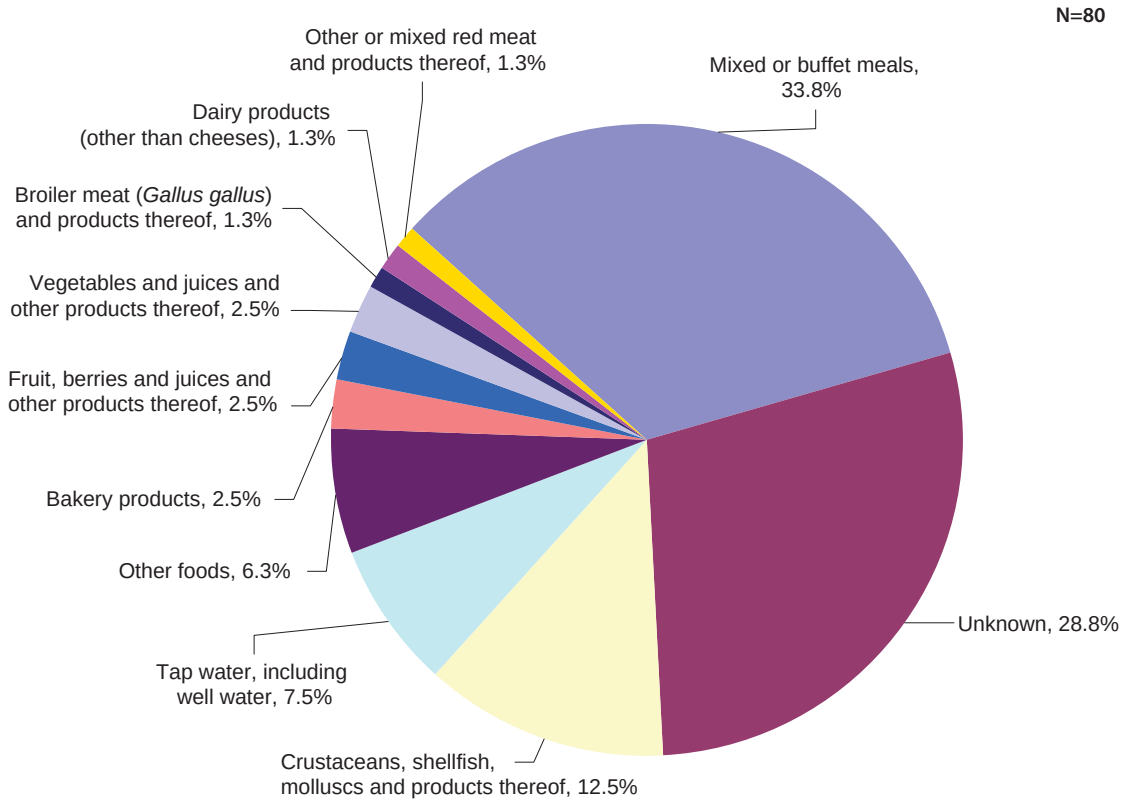
The proportion of unknown food vehicles implicated in outbreaks caused by viruses has decreased during the period 2005-2007 (Figure VI2). This might be because detailed information on food vehicles only from verified outbreaks was reported in 2007, as well as more detailed food categories, are now available in the EU reporting system. In 2005, crustaceans, shellfish, molluscs and products thereof, as well as buffet meals were not particularly specified.

The vast majority of reported settings in the verified calicivirus (including norovirus) outbreaks were restaurants (36.3%) and households (18.8%) (Figure VI3). One outbreak caused by the Tick-Borne Encephalitis Virus (TBE virus) was reported from Hungary. The outbreak was due to the consumption of raw milk from a goat with acute TBE infection. The foodstuffs were bought from a market and resulted in 27 human cases of which 23 were hospitalised (Table VI7).

The place of origin of the problem was reported in 32.7% of all verified outbreaks caused by viruses (Table VI8). The largest number of human cases, 33.6% of all human cases, originated from problems in restaurants or catering services. Primary production was reported as the origin of the problem of a norovirus outbreak after consumption of oysters in a restaurant.

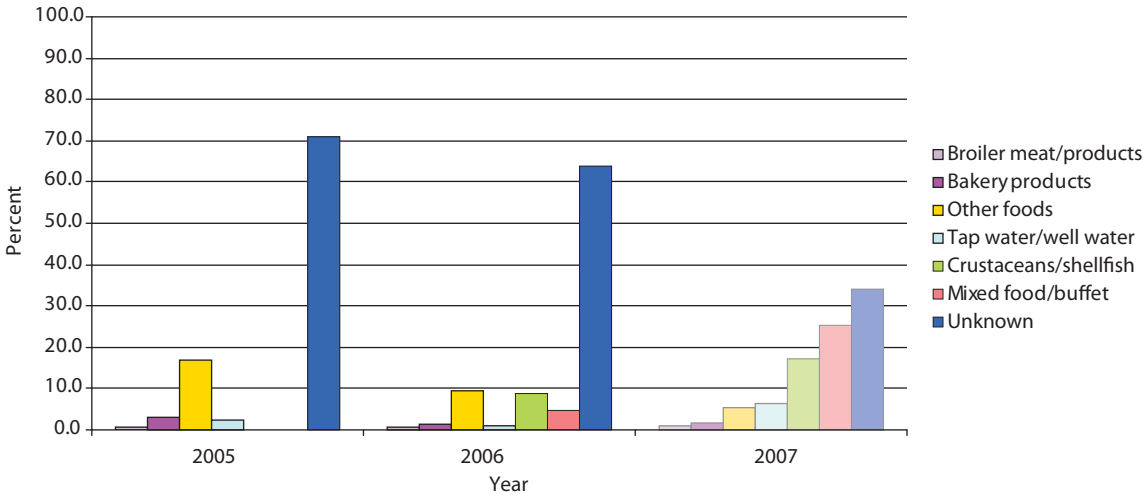
In total, several contributory factors were reported linked to the virus outbreaks. The one most often reported was an infected food handler (Table VI9).

Figure VI1. | ***Distribution of implicated foodstuffs in verified outbreaks caused by calicivirus (including norovirus), 2007***



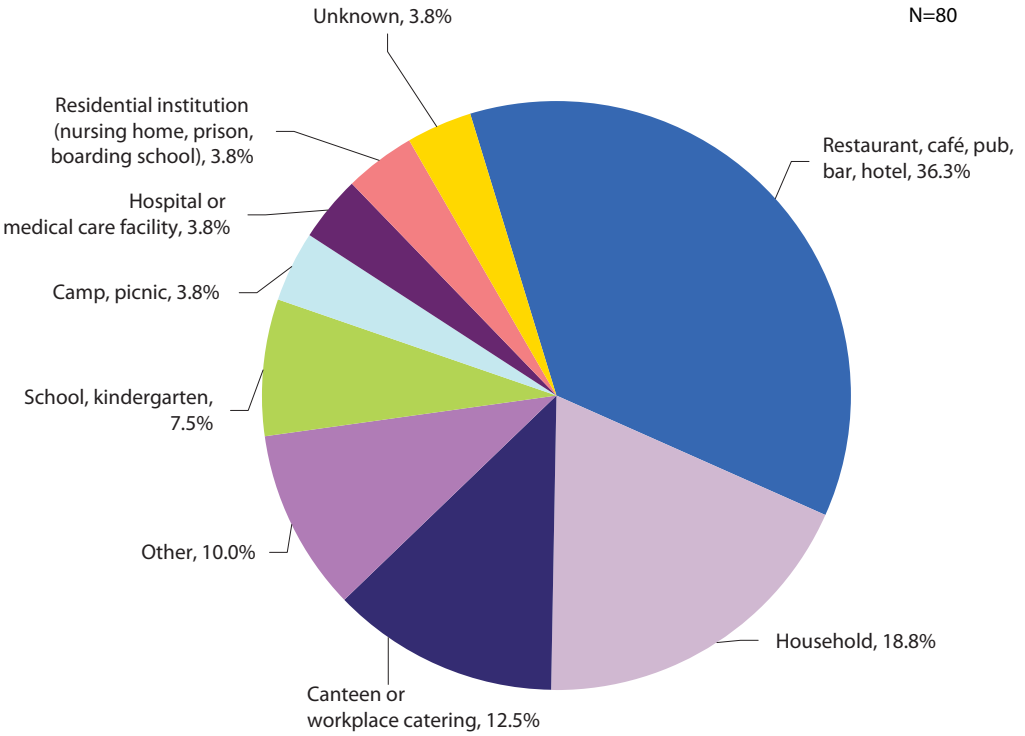
Note: includes data from 80 outbreaks: AT (1), BE (5), DK (22), FI (6), FR (21), DE (1), LV (1), NL (8), ES (10), SE (5)

Figure VI2: | ***Selected implicated foodstuffs in reported outbreaks caused by calicivirus (including norovirus), 2005-2007***



Note: for 2007, includes data from 80 verified outbreaks (11 MSs) and the bar colour shade is lighter. For 2006, includes data from all 577 reported outbreaks (18 MSs). For 2005, includes data from all 182 reported outbreaks (13 MSs). Detailed information on crustaceans/shellfish and mixed food/buffet only reported in 2006 and 2007. Data for 2007 is marked with a lighter colour shade

Figure VI3. | ***Distribution of settings in verified outbreaks caused by calicivirus (including norovirus), 2007***



Note: includes data from 80 outbreaks: AT (1), BE (5), DK (22), FI (6), FR (21), DE (1), LV (1), NL (8), ES (10), SE (5)

Table VI3. | ***Evidence in verified outbreaks, 2007***

Country	N	Causative agent detected in:		Laboratory characterisation of isolates	Analytical epidemiological evidence	Unknown
		Implicated foodstuff	Human cases			
Austria	1	0	1	0	1	0
Belgium	5	5	1	0	0	0
Denmark	23	0	11	0	0	12
Finland	6	1	6	1	2	0
France	46	7	14	0	31	0
Germany	1	1	1	0	0	0
Hungary	1	0	1	0	0	0
Latvia	2	0	2	0	0	0
Netherlands	8	1	7	0	8	0
Spain	13	0	0	0	0	13
Sweden	5	2	5	0	1	0
EU Total	**111**	**17**	**49**	**1**	**43**	**25**
Norway	2	0	2	0	0	0

Note: countries can report more than one type of evidence per outbreak

1. Causative agent is detected in both human cases and implicated foodstuffs followed by: calicivirus (including norovirus), rotavirus, and hepatitis A virus - genomic characterisation of strain (e.g. PCR and sequencing of the PCR product); flavivirus - speciation and genomic characterisation of strains (e.g. PCR and sequencing of the PCR product)

Table VI4. | ***Type of verified outbreaks caused by viruses, 2007***

Type	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
General	Calicivirus (including norovirus)	63	64.3	2,836	67	0
	TBE virus	1	1.0	27	23	0
	Hepatitis A virus	2	2.0	9	0	0
	Rotavirus	1	1.0	3	3	0
	Virus not specified	18	18.4	306	12	0
Household	Calicivirus (including norovirus)	7	7.1	105	1	0
	Virus not specified	6	6.1	58	2	0
EU Total		**98**	**100**	**3,344**	**108**	**0**

Note: Spain (N=13) is not included due to reporting aggregated data

Table VI5. | ***Implicated foodstuffs in verified virus outbreaks, 2007***

Implicated foodstuff	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Bakery products	Calicivirus (including norovirus)	2	2.0	67	0	0
Broiler meat (*Gallus gallus*) and products thereof	Calicivirus (including norovirus)	1	1.0	20	0	0
Crustaceans, shellfish, molluscs and products thereof	Calicivirus (including norovirus)	9	9.2	215	4	0
	Virus not specified	8	8.2	41	1	0
Dairy products (other than cheeses)	Calicivirus (including norovirus)	1	1.0	6	0	0
	TBE virus	1	1.0	27	23	0
Eggs and egg products	Virus not specified	1	1.0	13	3	0
Fish and fish products	Hepatitis A virus	2	2.0	9	0	0
Fruit, berries and juices and other products thereof	Calicivirus (including norovirus)	2	2.0	21	0	0
Milk	TBE virus	0	0	0	0	0
Mixed or buffet meals	Calicivirus (including norovirus)	27	27.6	978	3	0
	Virus not specified	1	1.0	13	0	0
Other or mixed red meat and products thereof	Calicivirus (including norovirus)	1	1.0	18	1	0
Tap water, including well water	Calicivirus (including norovirus)	5	5.1	526	37	0
Vegetables and juices and other products thereof	Calicivirus (including norovirus)	2	2.0	494	0	0
Other foods	Calicivirus (including norovirus)	1	1.0	31	0	0
	Virus not specified	1	1.0	19	0	0
Unknown	Calicivirus (including norovirus)	19	19.4	565	23	0
	Rotavirus	1	1.0	3	3	0
	Virus not specified	13	13.3	278	10	0
EU Total		**98**	**100**	**3,344**	**108**	**0**

Note: Spain (N=13) is not included due to reporting aggregated data

Table VI6. | ***Origin of implicated foodstuffs in verified outbreaks caused by viruses, 2007***

Origin	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Domestic	Calicivirus (including norovirus)	12	12.2	723	8	0
	TBE virus	1	1.0	27	23	0
	Rotavirus	1	1.0	3	3	0
Not relevant	Calicivirus (including norovirus)	8	8.2	365	2	0
Unknown	Calicivirus (including norovirus)	50	51.0	1,853	58	0
	Hepatitis A virus	2	2.0	9	0	0
	Virus not specified	24	24.5	364	14	0
EU Total		**98**	**100**	**3,344**	**108**	**0**

Note: Spain (N=13) is not included due to reporting aggregated data

Table VI7. | ***Settings in verified outbreaks caused by viruses, 2007***

Setting	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Camp, picnic	Calicivirus (including norovirus)	3	3.1	119	37	0
Canteen or work-place catering	Calicivirus (including norovirus)	9	9.2	317	1	0
	Virus not specified	2	2.0	34	0	0
Hospital or medical care facility	Calicivirus (including norovirus)	3	3.1	27	7	0
	Virus not specified	7	7.1	153	4	0
Household	Calicivirus (including norovirus)	15	15.3	566	1	0
	Virus not specified	6	6.1	58	2	0
Mobile retailer, market/street vendor	TBE virus	1	1.0	27	23	0
Residential institution (nursing home, prison, boarding school)	Calicivirus (including norovirus)	2	2.0	87	0	0
Restaurant, café, pub, bar, hotel	Calicivirus (including norovirus)	24	24.5	1,067	4	0
	Hepatitis A virus	1	1.0	2	0	0
	Virus not specified	5	5.1	44	0	0
School, kindergarten	Calicivirus (including norovirus)	6	6.1	362	1	0
	Rotavirus	1	1.0	3	3	0
	Virus not specified	1	1.0	19	0	0
Other setting	Calicivirus (including norovirus)	7	7.1	251	17	0
	Hepatitis A virus	1	1.0	7	0	0
	Virus not specified	2	2.0	24	8	0
Unknown	Calicivirus (including norovirus)	1	1.0	145	0	0
	Virus not specified	1	1.0	32	0	0
EU Total		**98**	**100**	**3,344**	**108**	**0**

Note: Spain (N=13) is not included due to reporting aggregated data

Table VI8. | ***Origin of the problem in verified outbreaks caused by viruses, 2007***

Origin	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Catering services, restaurant	Calicivirus (including norovirus)	19	19.4	1,125	2	0
Farm (primary production)	Calicivirus (including norovirus)	1	1.0	30	0	0
Household, domestic kitchen	Calicivirus (including norovirus)	4	4.1	89	0	0
	TBE virus	1	1.0	27	23	0
Processing plant	Calicivirus (including norovirus)	1	1.0	17	0	0
Retail sale outlet	Rotavirus	1	1.0	3	3	0
Water distribution system	Calicivirus (including norovirus)	1	1.0	293	0	0
Water source	Calicivirus (including norovirus)	3	3.1	88	37	0
Water treatment plant	Calicivirus (including norovirus)	1	1.0	145	0	0
Unknown	Calicivirus (including norovirus)	40	40.8	1,154	29	0
	Hepatitis A virus	2	2.0	9	0	0
	Virus not specified	24	24.5	364	14	0
EU Total		**98**	**100**	**3,344**	**108**	**0**

Note: Spain (N=13) is not included due to reporting aggregated data

Table VI9. | ***Contributory factors in verified outbreaks caused by viruses, 2007***

Factor	Causative agent	Number of reportings
Cross-contamination	Calicivirus (including norovirus)	4
	Virus not specified	4
Inadequate heat treatment	Calicivirus (including norovirus)	1
	Virus not specified	1
Infected food handler	Calicivirus (including norovirus)	16
Unprocessed contaminated ingredient	Calicivirus (including norovirus)	4
	TBE virus	1
	Rotavirus	1
	Virus not specified	1
Water treatment failure	Hepatitis A virus	2
Unknown	Calicivirus (including norovirus)	45
	Virus not specified	20
EU Total		**100**

Note: MSs can report more than one contributory factor per outbreak

Spain (N=13) is not included due to reporting aggregated data

Parasites | 3.9

3.9 | Parasites

Numerous parasites can cause food-borne outbreaks and only parasites reported in 2007 are presented here.

Giardia lamblia is a protozoan parasite that colonises the upper part of the small intestine of its vertebrate host, causing giardiasis. Symptoms of infection include diarrhoea, malaise, excessive gas, steatorrhea, epigastric pain, bloating, nausea, and weight loss. Giardiasis is not fatal and in healthy individuals the condition is usually self-limiting. *Giardia* infection is initiated through ingestion of *Giardia* cysts from contaminated water or food. *Giardia* cysts can survive for months in cold water and as cysts are resistant to conventional water treatment methods, such as chlorination and ozonation, the parasite may persist after water treatment.

Sarcocystis species are intracellular protozoan parasites. Human infection of the parasite is known as sarcosporidiosis and intestinal infections are self-limiting, of short duration, and often asymptomatic, although symptoms like nausea, abdominal pain, and diarrhoea have been observed.

Cryptosporidiosis is a parasitic disease caused by the protozoan parasite *Cryptosporidium parvum*. Infection is initiated by ingestion of resistant oocysts from contaminated food or water. The main symptom is self-limiting diarrhoea that lasts up to two weeks. Transmission occurs through animal-to-human or human-to-human contact.

Trichinella infections in humans are typically acquired by eating raw or inadequately cooked meat contaminated with infectious larvae. The most common sources of human infection are pig meat, wild boar meat and other game meat. The first phase of trichinellosis symptoms may include nausea, diarrhoea, vomiting, fatigue, fever and abdominal discomfort. Thereafter, a second phase of symptoms including muscle pains, headaches, fevers, eye swelling, aching joints, chills, cough, itchy skin, diarrhoea or constipation may follow. In more severe cases, difficulties with coordinating movements as well as heart and breathing problems may occur. A small proportion of cases die from trichinellosis infection.

Parasitic food-borne outbreaks in 2007

Eight MSs reported a total of 57 food-borne outbreaks caused by parasites. Together 35 of these outbreaks were verified, out of which 33 were *Trichinella* outbreaks reported by six MSs.

Germany, Poland and Romania accounted for 77.2% of parasitic outbreaks reported in 2007. The total number of outbreaks caused by parasites in the EU has increased by 29.5% compared to 2006 especially due to 17 outbreaks reported by Romania. In addition, Norway, a non-MS, reported two parasitic outbreaks (Table Pa1). In the EU, parasites caused 1.0% of the total reported food-borne outbreaks (Table GE5).

In the EU, 61.4% of reported parasite outbreaks were verified. Romania accounted for 17 of these outbreaks (48.6%) and all cases in the outbreaks were admitted to hospital. In the EU overall, the hospital admission rate was 45.2% for parasite outbreaks (Table Pa2).

Table Pa1. | ***Reported food-borne outbreaks caused by parasites, 2005-2007***

Country	2007				2006	2005
	N	Reporting rate per 100,000[1]	Verified outbreaks	% Verified outbreaks	N	N
Austria	-	-	-	-	1	0
Belgium	-	-	-	-	4	0
Denmark	-	-	-	-	-	1
France	-	-	-	-	2	0
Germany	14	0.02	2	14.3	18	17
Ireland	4	0.09	2	50.0	1	0
Italy	-	-	-	-	1	0
Latvia	1	0.04	0	0	3	5
Lithuania	2	0.06	1	50.0	3	1
Malta	-	-	-	-	-	2
Poland	13	0.03	8	61.5	7	0
Romania	17	0.08	17	100	0	0
Slovakia	1	0.02	0	0	1	0
Slovenia	-	-	-	-	1	2
Spain	5	0.01	5	100	2	1
EU Total	**57**	**0.01**	**35**	**61.4**	**44**	**29**
Norway	2	0.04	2	100	1	0

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Table Pa2. | ***Verified food-borne outbreaks caused by parasites, 2005-2007***

Agent	Country	Outbreaks			Human cases		
		N	% of EU total	Reporting rate per 100,000[1]	N	Hospitalisations	Deaths
Cryptosporidium spp., unspecified	Ireland	1	100	0.02	186	41	0
	EU Total	**1**	**100**	**0.02**	**186**	**41**	**0**
	Norway	1		0.02	33	0	0
Giardia lamblia	Norway	1		0.02	5	0	0
Sarcocystis spp., unspecified	Germany	1	100	<0.01	28	0	0
	EU Total	**1**	**100**	**<0.01**	**28**	**0**	**0**
Trichinella spiralis	Germany	1	25.0	<0.01	3	3	0
	Ireland	1	25.0	0.02	2	1	0
	Poland	2	50.0	0.01	236	88	0
	EU Total	**4**	**100**	**<0.01**	**241**	**92**	**0**
Trichinella spp., unspecified	Lithuania	1	3.4	0.03	6	6	0
	Poland	6	20.7	0.02	55	42	0
	Romania	17	58.6	0.08	139	139	0
	Spain	5	17.2	0.01	91	17	0
	EU Total	**29**	**100**	**0.01**	**291**	**204**	**0**

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Detailed information from verified outbreaks

A total of 35 verified parasite outbreaks were reported by MSs. However, detailed outbreak information was only available for the 30 outbreaks presented in Tables Pa4 to Pa9.

The type of evidence verifying the outbreak was agent detection from human cases in 31.4% of outbreaks and from the implicated foodstuff in 62.9% of outbreaks (Table Pa3). *Trichinella* was detected in all the 17 Romanian outbreaks from samples of raw or unprocessed pig meat originating from backyard pigs.

Information on the type of outbreak was available for all verified outbreaks. General outbreak was reported as the type in 63.3% of outbreaks and they caused 94.2% of human cases and 89.1% of hospitalisations (Table Pa4).

Information on the implicated foodstuff was provided in all verified parasitic outbreaks (Table Pa5). Overall, 76.7% of all verified parasitic outbreaks were caused by infected pig meat and products thereof. These outbreaks accounted for 62.3% of human cases and 75.3% of hospitalisations. In addition several *Trichinella* outbreaks were caused by the consumption of wild boar meat. One waterborne (tap water) *Cryptosporidium* outbreak in Ireland involved 186 cases, representing 28.4% of the total number of human cases infected with parasites.

The origin of the foodstuff was reported in 27 out of 30 verified parasitic outbreaks (Table Pa6) and 90% of all reported outbreaks originated from domestically produced foodstuffs. In all verified outbreaks, households were reported as the settings (Table Pa7).

The place of origin of the problem was reported in 66.7% of all verified outbreaks caused by parasites. In 85.0% of these outbreaks, the origin of the problem was reported to be household. This was also the case in all Romanian outbreaks. The origin of the problem was travel abroad in one *Trichinella* outbreak and water treatment plan in the *Cryptosporidium* outbreak (Table Pa8). Unprocessed contaminated raw pig meat was listed as a contributory factor in 60% of outbreaks (Table Pa9).

Table Pa3. | ***Evidence in verified outbreaks, 2007***

Country	N	Causative agent detected in:		Laboratory characterisation of isolates [1]	Analytical epidemiological evidence	Unknown
		Implicated foodstuff	Human cases			
Germany	2	2	1	0	0	0
Ireland	2	1	2	0	0	0
Lithuania	1	1	0	0	0	0
Poland	8	1	8	0	0	0
Romania	17	17	0	0	0	0
Spain	5	0	0	0	0	5
EU Total	**35**	**22**	**11**	**0**	**0**	**5**
Norway	2	0	2	0	0	0

Note: countries can report more than one type of evidence per outbreak

1. Causative agent is detected in both human cases and implicated foodstuffs followed by: *Giardia* and *Cryptosporidium* - genotyping (PCR, RFLP); *Trichinella* - only 'laboratory detection' possible as in humans only serology is usually carried out, which does not go beyond the genus level

Table Pa4. | ***Type of verified outbreaks caused by parasites, 2007***

Type	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
General	*Cryptosporidium* spp., unspecified	1	3.3	186	41	0
	Sarcocystis spp., unspecified	1	3.3	28	0	0
	Trichinella spiralis	2	6.7	236	88	0
	Trichinella spp., unspecified	15	50.0	167	156	0
Household	*Trichinella spiralis*	2	6.7	5	4	0
	Trichinella spp., unspecified	9	30.0	33	31	0
EU Total		**30**	**100**	**655**	**320**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table Pa5. | ***Foodstuffs implicated in verified outbreaks caused by parasites, 2007***

Implicated foodstuff	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Other or mixed red meat and products thereof (wild boar)	*Trichinella spiralis*	1	3.3	12	1	0
	Trichinella spp., unspecified	6	20.0	49	37	0
Pig meat and products thereof	*Sarcocystis* spp., unspecified	1	3.3	28	0	0
	Trichinella spiralis	2	6.7	229	91	0
	Trichinella spp., unspecified	19	63.3	151	150	0
Tap water, including well water	*Cryptosporidium* spp., unspecified	1	3.3	186	41	0
EU Total		**30**	**100**	**655**	**320**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table Pa6. | ***Origin of foodstuffs in verified outbreaks caused by parasites, 2007***

Origin	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Domestic	*Cryptosporidium* spp., unspecified	1	3.3	186	41	0
	Trichinella spiralis	2	6.7	236	88	0
	Trichinella spp., unspecified	24	80.0	200	187	0
Not relevant	*Trichinella spiralis*	1	3.3	2	1	0
	Sarcocystis spp., unspecified	1	3.3	28	0	0
	Trichinella spiralis	1	3.3	3	3	0
EU Total		**30**	**100**	**655**	**320**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table Pa7. | ***Settings in verified outbreaks caused by parasites, 2007***

Setting	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Household	*Cryptosporidium* spp., unspecified	1	3.3	186	41	0
	Sarcocystis spp., unspecified	1	3.3	28	0	0
	Trichinella spiralis	4	13.3	241	92	0
	Trichinella spp., unspecified	24	80.0	200	187	0
EU Total		**30**	**100**	**655**	**320**	**0**

Note: Spain (N=5) is not included due to reporting aggregated data

Table Pa8. | ***Origin of the problem in verified outbreaks caused by parasites, 2007***

Origin	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Household, domestic kitchen	*Trichinella* spp., unspecified	17	56.7	139	139	0
Slaughterhouse	*Trichinella* spp., unspecified	1	3.3	6	6	0
Travel abroad	*Trichinella spiralis*	1	3.3	2	1	0
Water treatment plant	*Cryptosporidium* spp., unspecified	1	3.3	186	41	0
Unknown	*Sarcocystis* spp., unspecified	1	3.3	28	0	0
	Trichinella spiralis	3	10.0	239	91	0
	Trichinella spp., unspecified	6	20.0	55	42	0
EU Total		**30**	**100**	**655**	**320**	**0**

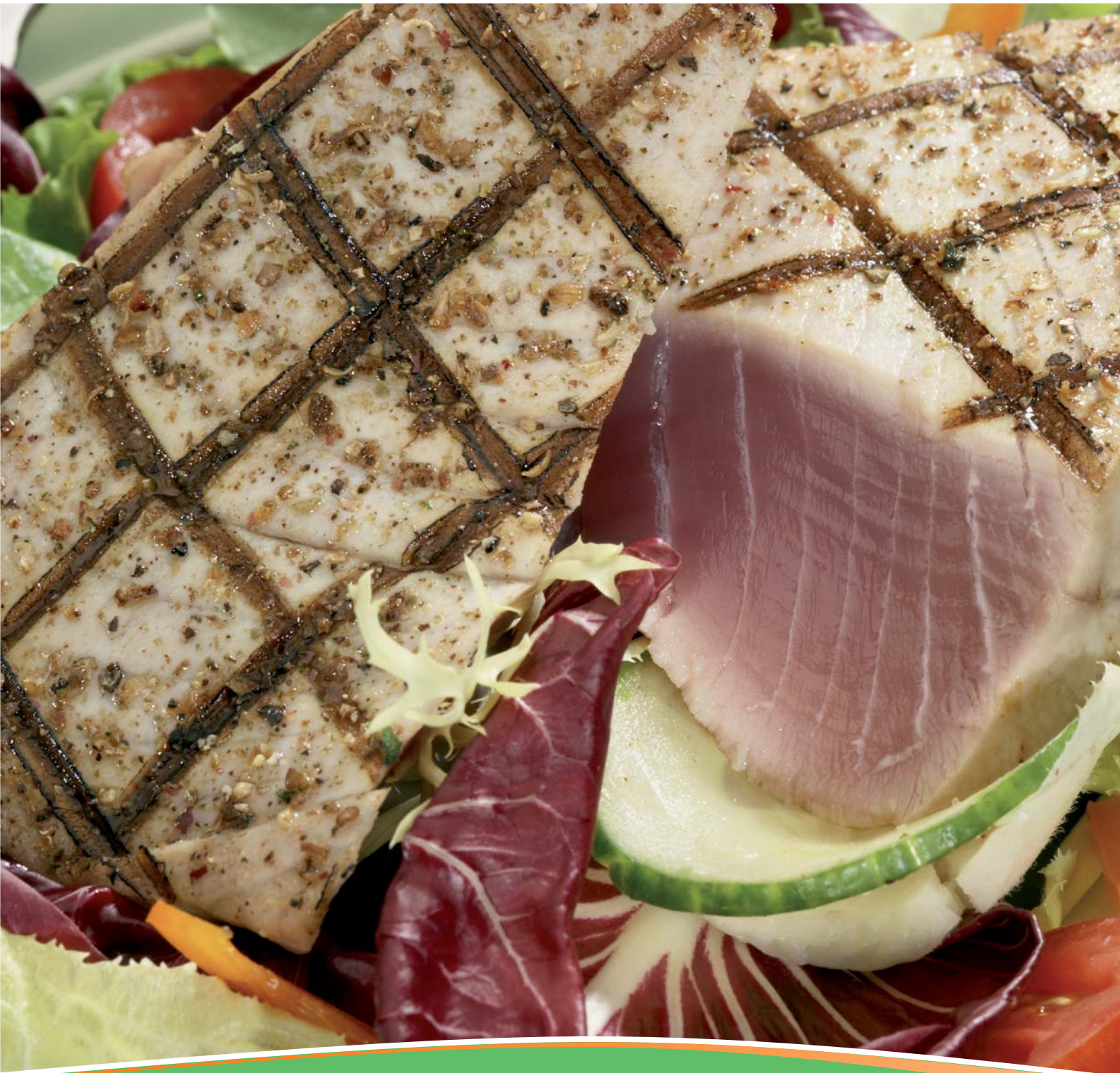
Note: Spain (N=5) is not included due to reporting aggregated data

Table Pa9. | ***Contributory factors in verified outbreaks caused by parasites, 2007***

Factor	Causative agent	Number of reportings
Unprocessed contaminated ingredient	*Sarcocystis* spp., unspecified	1
	Trichinella spp., unspecified	17
Unknown	*Cryptosporidium* spp., unspecified	1
	Trichinella spiralis	4
	Trichinella spp., unspecified	7
EU Total		**30**

Note: MSs can report more than one contributory factor per outbreak

Spain (N=5) is not included due to reporting aggregated data



Other causative agents | 3.10

3.10 | Other causative agents

In this report the other causative agents include histamine, lectin, marine biotoxins and mushroom toxins as well as unspecified toxins.

Histamine is a biogenic amine involved in local immune responses as well as regulating physiological functions. It is found in virtually all animal body cells. Scombroid food poisoning results from eating spoiled (decayed) fish containing high amounts of histamine. Other chemicals have been found in decaying fish flesh, but their association to scombroid fish poisoning has not been clearly established. Symptoms consist of skin flushing, throbbing headache, oral burning, abdominal cramps, nausea, diarrhoea, palpitations, a sense of unease, and, rarely, prostration or loss of vision. It is most commonly reported with tuna, mahi-mahi, bonito, sardines, anchovies, and related species of fish that were inadequately refrigerated or preserved after being caught.

Lectins are sugar-binding proteins which are highly specific for their sugar moieties. Lectins are found in all foods. The most common potentially 'toxic' lectin containing food groups are grains, especially wheat and wheat germ but also quinoa, rice, buckwheat, oats, rye, barley, millet and corn, legumes (all dried beans, including soy and peanuts). Symptoms of poisoning are nausea, diarrhoea and vomiting.

Other causative agent outbreaks in 2007

Eleven MSs reported a total of 204 food-borne outbreaks due to other causative agents such as histamine, marine biotoxins, mushroom toxins and lectin which constituted 3.6% of the total number of reported outbreaks in the EU (Table GE5).

In 2007, outbreaks occurring in France and Hungary accounted for 59.3% of other causative agent outbreaks. The overall outbreak reporting rate in the EU was 0.05 per 100,000 population, ranging from <0.01 per 100,000 in the United Kingdom to 0.53 per 100,000 in Lithuania. One non-MS reported one outbreak (Table OCa1).

Table OCa1. | ***Reported food-borne outbreaks caused by other causative agents, 2005-2007***

Country	2007				2006	2005
	N	Reporting rate per 100,000[1]	Verified outbreaks	% Verified outbreaks	N	N
Austria	1	0.07	1	100	2	-
Belgium	-	-	-	-	2	1
Denmark	8	0.15	8	100	2	-
Finland	4	0.08	4	100	3	1
France	82	0.13	82	100	76	-
Greece	2	0.02	0	0	-	-
Hungary	39	0.39	36	92.3	33	-
Lithuania	18	0.53	0	0	-	-
Malta	-	-	-	-	-	3
Netherlands	-	-	-	-	1	1
Poland	16	0.04	4	25.0	22	-
Spain	26	0.06	26	100	-	-
Sweden	5	0.05	1	20.0	6	1
United Kingdom	3	<0.01	0	0	3	4
EU Total	**204**	**0.05**	**162**	**79.4**	**150**	**11**
Norway	-	-	-	-	2	1
Switzerland	1	0.01	1	100	-	-

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

In the EU, 79.4% of the total reported outbreaks caused by other causative agents were verified. The verified outbreaks were primarily from France, which accounted for 50.6% of all verified outbreaks due to other causative agents, with 50 outbreaks being due to histamine (Table OCa2).

Table OCa2. | ***Verified food-borne outbreaks caused by other causative agents, 2007***

Agent	Country	Outbreaks			Human cases		
		N	% of EU total	Reporting rate per 100,000[1]	N	Hospitalisations	Deaths
Histamine	Denmark	2	2.9	0.04	8	-	-
	Finland	4	5.8	0.08	16	-	-
	France	50	72.5	0.08	369	56	-
	Spain	12	17.4	0.03	140	-	-
	Sweden	1	1.4	0.01	10	-	-
	EU Total	**69**	**100**	**0.02**	**543**	**56**	**-**
	Switzerland	1		0.01	17	-	-
Lectin	Denmark	1	100	0.02	6	-	-
	EU Total	**1**	**100**	**0.02**	**6**	**-**	**-**
Marine biotoxins	France	25	100	0.04	256	3	-
	EU Total	**25**	**100**	**0.04**	**256**	**3**	**-**
Mushroom toxins	Hungary	36	83.7	0.36	119	117	-
	Poland	4	9.3	0.01	10	9	-
	Spain	3	7.0	<0.01	25	-	-
	EU Total	**43**	**100**	**0.01**	**154**	**126**	**-**
Other causative agents	Denmark	5	22.7	0.09	28	-	-
	France	6	27.3	<0.01	209	26	1
	Spain	11	50.0	0.02	227	4	-
	EU Total	**22**	**100**	**<0.01**	**464**	**30**	**1**
Other toxins	Austria	1	50.0	0.01	8	7	-
	France	1	50.0	<0.01	3	-	-
	EU Total	**2**	**100**	**<0.01**	**11**	**7**	**-**

1. The EU reporting rate per 100,000 is based on the population in the 22 reporting MSs

Detailed information from verified outbreaks

A total of 162 verified outbreaks due to other causative agents were reported by MSs. However, detailed information on outbreaks was only available for 136 outbreaks presented in Tables OCa4 to OCa9 because Spain reported aggregated data (26 outbreaks). All tables with detailed information on outbreaks caused by other causative agents are presented at the end of this section.

The type of evidence verifying the outbreaks was detection of the agent from human cases in 19.8% of the outbreaks and from the implicated foodstuff in 34.6% of outbreaks. The causative agent was laboratory characterised both from the implicated foodstuff and human cases in only one outbreak. Analytical epidemiological evidence was presented in 38.9% of the outbreaks (Table OCa3).

Information on the type of verified outbreaks was available for all verified outbreaks. There were slightly more general outbreaks (56.6%) reported than household outbreaks (43.4%). However, general outbreaks accounted for 82.1% of human cases, 58.7% of hospitalisations, and caused one death (Table OCa4).

Overall, information on the implicated foodstuff was provided in 131 of the verified outbreaks with 56.6% of the outbreaks being caused by products of marine origin (histamine, marine biotoxins) (Table OCa5).

The origin of the foodstuff was only reported in 33.8% of all verified outbreaks caused by other causative agents (Table OCa6), of which 30.1% originated from domestically produced foodstuffs.

The vast majority of reported settings in the verified outbreaks were households (49.3%) and restaurants (27.9%), primarily caused by histamine, marine biotoxins, and mushroom toxins (Table OCa7).

In only 32.4% of all verified outbreaks caused by other causative agents, the place of origin of the problem was reported, with 27.2% of the verified outbreaks originating in the household caused by histamine and mushroom toxins (Table OCa8).

Contributory factors that were reported for histamine outbreaks included storage time and unprocessed contaminated ingredients. Unprocessed contaminated ingredients were also reported as a contributory factor for marine biotoxin outbreaks (Table OCa9).

Table OCa3. | ***Evidence in verified outbreaks, 2007***

Country	N	Causative agent detected in:		Laboratory characterisation of isolates[1]	Analytical epidemiological evidence	Unknown
		Implicated foodstuff	Human cases			
Austria	1	1	1	1	0	0
Denmark	8	1	0	0	0	7
Finland	4	4	0	0	0	0
France	82	22	2	0	62	0
Hungary	36	26	27	0	0	1
Poland	4	1	2	0	1	0
Spain	26	0	0	0	0	26
Sweden	1	1	0	0	0	0
EU Total	**162**	**56**	**32**	**1**	**63**	**34**
Switzerland	1	1	0	1	0	0

Note: countries can report more than one type of evidence per outbreak

1. Causative agent is detected in both human cases and implicated foodstuffs, and a further characterisation is done to link human cases to the implicated food and to each other based on the causative agent in the outbreak

Table OCa4. | ***Type of verified outbreaks caused by other causative agents, 2007***

Type	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
General	Histamine	46	33.8	368	54	0
	Lectin	1	0.7	6	0	0
	Marine biotoxins	12	8.8	200	3	0
	Mushroom toxins	7	5.1	38	38	0
	Other causative agents	10	7.4	235	26	1
	Other toxins	1	0.7	8	7	0
Household	Histamine	11	8.1	35	2	0
	Marine biotoxins	13	9.6	56	0	0
	Mushroom toxins	33	24.3	91	88	0
	Other causative agents	1	0.7	2	0	0
	Other toxins	1	0.7	3	0	0
EU Total		**136**	**100**	**1,042**	**218**	**1**

Note: Spain (N=26) is not included due to reporting aggregated data

Table OCa5. | ***Implicated foodstuffs in verified outbreaks caused by other causative agents, 2007***

Implicated foodstuffs	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Bovine meat and products thereof	Other causative agents	1	0.7	11	0	0
Canned food products	Histamine	2	1.5	6	0	0
Cheese	Histamine	2	1.5	6	2	0
Crustaceans, shellfish, molluscs and products thereof	Marine biotoxins	17	12.5	235	3	0
	Other causative agents	1	0.7	100	0	0
Fish and fish products	Histamine	52	38.2	382	53	0
	Marine biotoxins	7	5.1	18	0	0
Pig meat and products thereof	Other causative agents	1	0.7	4	0	0
Vegetables and juices and other products thereof	Lectin	1	0.7	6	0	0
	Other causative agents	4	2.9	10	0	0
Other foods	Mushroom toxins	40	29.4	129	126	0
	Other toxins	2	1.5	11	7	0
	Other causative agents	1	0.7	18	0	0
Unknown	Histamine	1	0.7	9	1	0
	Marine biotoxins	1	0.7	3	0	0
	Other causative agents	3	2.2	94	26	1
EU Total		**136**	**100**	**1,042**	**218**	**1**

Note: Spain (N=26) is not included due to reporting aggregated data

Table OCa6. | ***Origin of implicated foodstuffs in verified outbreaks caused by other causative agents, 2007***

Origin	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Domestic	Mushroom toxins	40	29.4	129	126	0
	Other toxins	1	0.7	8	7	0
Imported from outside the EU	Histamine	5	3.7	26	0	0
Unknown	Histamine	52	38.2	377	56	0
	Lectin	1	0.7	6	0	0
	Marine biotoxins	25	18.4	256	3	0
	Other causative agents	11	8.1	237	26	1
	Other toxins	1	0.7	3	0	0
EU Total		**136**	**100**	**1,042**	**218**	**1**

Note: Spain (N=26) is not included due to reporting aggregated data

Table OCa7. | ***Settings in verified outbreaks caused by other causative agents, 2007***

Setting	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Canteen or workplace catering	Histamine	5	3.7	21	0	0
Hospital or medical care facility	Histamine	3	2.2	9	3	0
	Other causative agents	2	1.5	68	0	1
Household	Histamine	12	8.8	39	2	0
	Marine biotoxins	13	9.6	56	0	0
	Mushroom toxins	38	27.9	125	122	0
	Other toxins	1	0.7	3	0	0
	Other causative agents	3	2.2	7	0	0
Residential institution (nursing home, prison, boarding school)	Other toxins	1	0.7	8	7	0
Restaurant, café, pub, bar, hotel	Histamine	31	22.8	91	23	0
	Lectin	1	0.7	6	0	0
	Marine biotoxins	4	2.9	90	0	0
	Other causative agents	2	1.5	7	0	0
School, kindergarten	Histamine	2	1.5	17	0	0
	Marine biotoxins	1	0.7	10	0	0
	Mushroom toxins	1	0.7	2	2	0
Other setting	Histamine	4	2.9	226	28	0
	Marine biotoxins	7	5.1	100	3	0
	Mushroom toxins	1	0.7	2	2	0
	Other causative agents	4	3	155	26	0
EU Total		**136**	**100**	**1,042**	**218**	**1**

Note: Spain (N=26) is not included due to reporting aggregated data

Table OCa8. | ***Origin of problem in verified outbreaks caused by other causative agents, 2007***

Origin	Causative agent	Outbreaks		Human cases		
		N	% of EU total	N	Hospitalisations	Deaths
Catering services, restaurant	Lectin	1	0.7	6	0	0
	Other toxins	1	0.7	8	7	0
	Other causative agents	1	0.7	3	0	0
Farm (primary production)	Histamine	2	1.5	15	0	0
Household, domestic kitchen	Histamine	1	0.7	4	0	0
	Mushroom toxins	34	25.0	115	113	0
	Other causative agents	2	1.5	5	0	0
Other place of origin	Mushroom toxins	2	1.5	4	4	0
Unknown	Histamine	54	39.7	384	56	0
	Marine biotoxins	25	18.4	256	3	0
	Mushroom toxins	4	2.9	10	9	0
	Other toxins	1	0.7	3	0	0
	Toxins unspecified	0	0	0	0	0
	Other causative agents	8	5.9	229	26	1
EU Total		**136**	**100**	**1,042**	**218**	**1**

Note: Spain (N=26) is not included due to reporting aggregated data

Table OCa9. | ***Contributory factors in verified outbreaks caused by other causative agents, 2007***

Factor	Causative agent	Number of reportings
Storage time/temperature abuse	Histamine	4
	Other causative agents	1
Unprocessed contaminated ingredient	Histamine	12
	Marine biotoxins	10
	Other toxins	1
	Other causative agents	1
Other contributory factor	Histamine	3
	Marine biotoxins	2
	Other causative agents	1
Unknown	Histamine	39
	Lectin	1
	Marine biotoxins	13
	Mushroom toxins	40
	Other toxins	1
	Other causative agents	8
EU Total		**137**

Note: MSs can report more than one contributory factor per outbreak

Spain (N=26) is not included due to reporting aggregated data

Waterborne outbreaks | 4

Waterborne outbreaks may potentially be large, especially if the public drinking water supply is contaminated. Hospitals and institutions hosting young children or elderly people are the most affected settings in such situations. Laboratory detection of pathogens from water can be complicated, especially if the level of contamination is low. In waterborne outbreaks several zoonotic pathogenic agents are often detected in the water as well as in the human samples as a result of unspecific contamination, e.g. with sewage water. Contaminated water can spread pathogenic agents further to other foodstuffs (e.g. vegetables), either in primary production or during food preparation.

In 2007, eight MSs[17] reported 17 waterborne outbreaks involving 10,912 human cases with 232 hospitalisations.

Finland reported the two largest waterborne outbreaks. One outbreak due to the contamination of the community water supply with purified sewage water, so-called technical water, caused, according to a population survey, about 8,000 cases of gastroenteritis. Approximately 1,000 people sought medical care and approximately 200 were hospitalised. Three major (*Campylobacter,* norovirus, *Giardia*), and three minor causative agents (*Salmonella* Enteritidis, *Clostridium difficile* and rotavirus) were isolated, and all the causative agents were isolated from water samples, too. However, only a relatively small number of the patients were tested microbiologically. Approximately 200 cases for *Campylobacter* and 60 for *Giardia* were laboratory confirmed, and more than one agent was isolated from several patients. In this outbreak, treated wastewater had leaked into the clean water supply when water treatment plant employees accidentally opened the wrong valve during maintenance work. Schools in the affected area were closed for a week. In an effort to limit secondary transmissions of infections, health authorities advised ill people not to return to work or school for at least two days after the symptoms had cleared up. The persistence of norovirus in the water distribution system in some areas required that people in the affected areas be advised to boil the water before use for a ten-week period. The second Finnish outbreak due to contaminated tap water caused 2,000 human cases. The causative agent was unknown.

In Sweden, two outbreaks related to water were reported. One outbreak was linked to well water, caused by an overflow of the sewage system resulting in 35 human cases. Norovirus was isolated from the water as well as from human cases. The other waterborne outbreak was linked to tap water after repair of the water system had been carried out. A total of 293 human cases were reported and norovirus, rotavirus and *Campylobacter* were isolated from human cases.

In Ireland, tap water from a community water supply was contaminated with *Cryptosporidium* at the water treatment plant, and 186 cases were registered. The parasite was detected in the water and in human cases.

In Denmark, 6,000 inhabitants and a number of companies were prohibited from using the local community water supply for several weeks following contamination of the water supply due to a leak of semi-purified sewage into the drinking water system. In total, 453 cases were registered and stool samples from 77 cases were tested positive. Norovirus, *Campylobacter* (*C. jejuni*, *C. coli* and *C. lari*) and a number of other infectious agents, including different types of diarrheagenic *E. coli*, different *Salmonella* serovars, *Giardia* and *Blastocystis hominis*, were detected.

A water treatment failure in Slovenia resulted in an outbreak with pathogenic *Escherichia coli*, affecting 43 people and hospitalising one. Pathogenic *E. coli* was laboratory confirmed both in human cases and in water samples.

In Norway, a large waterborne outbreak took place where more than 1,000 people were infected with *Campylobacter jejuni*. A case control study was conducted and the results showed that tap water was the source. The agent was not isolated from water samples after the outbreak.

17. DK, FI, IE, NL, PL, SI, ES and SE

Evaluation of data received from the new reporting system | 5

5.1 | Description of the new reporting system

The new reporting system for food-borne outbreaks was implemented in 2007 and it differentiates between two categories of food-borne outbreaks according to evidence available supporting the food-borne nature of the outbreak. Verified food-borne outbreaks are defined as outbreaks compatible with descriptive epidemiological evidence and at least one of the following: either laboratory detection of the causative agent in implicated foodstuffs and/or analytical epidemiological evidence. Possible food-borne outbreaks are defined as outbreaks compatible with descriptive epidemiological evidence alone, including outbreaks where the causative agent is unknown. In this context, descriptive epidemiological evidence means information linking two or more people with clinical symptoms consistent with a disease caused by the same pathogen from a possible common food vehicle.

Food-borne outbreaks caused by chemical agents are not covered by the reporting system at this stage.

Many MSs manage human communicable disease surveillance systems in the public health sector which, among others, also cover food-borne diseases and outbreaks, whereas veterinary and food safety authorities have traditionally concentrated on the managerial aspects of food safety. Therefore, monitoring food-borne outbreaks is of common interest to food and human health authorities in MSs as well as to EFSA and ECDC at Community level.

The collection of data on investigated food-borne outbreaks provides information on causative agents, food vehicles and the factors in food preparation and handling that contributed to the outbreaks. At Community level, the information collected from MSs should facilitate the evaluation of trends in food-borne outbreaks and the vehicles of the outbreaks. In particular, the data on food-borne outbreaks is collected to give an overview of and to assess:

- trends in the number and size of food-borne outbreaks and the proportion of outbreaks related to different causative agents,
- the severity of the disease in the human cases involved,
- the importance of different food categories as outbreak vehicles, and,
- factors contributing to the occurrence of food-borne outbreaks.

The added value concerns especially the information on the causative agent - food vehicle combinations responsible for food-borne outbreaks. This information is necessary when targeting actions to improve food safety in the Community. This information will increase the understanding of the epidemiology of the causative agents and could also be used for risk assessments.

5.2 | Data received

Verified or possible food-borne outbreaks

A total of 19 MSs reported data on 2,025 verified food-borne outbreaks. In addition, two non-MSs reported 36 verified outbreaks. Greece, Malta and the United Kingdom reported only possible outbreaks. Bulgaria, Cyprus, Italy, Luxembourg and Portugal did not submit any data. Verified outbreaks constituted 36.1% of all the outbreaks reported, whereas the rest were possible outbreaks. The share of the reported verified food-borne outbreaks and the possible outbreaks varied greatly between MSs. Some MSs (Greece, Malta, and the United Kingdom) reported only possible outbreaks, whereas in other MSs (Denmark, Finland, France, Slovenia, and Spain) all the reported outbreaks were verified. In the remaining reporting MSs, the proportion of verified outbreaks ranged from 2.5% to 88.1%. This is an interesting outcome and there may be a number of reasons for this. Firstly, these include different and sometimes erroneous interpretation of the criteria for the classification of outbreaks between possible and verified. Another cause may be the differences in the sensitivity of the investigation and reporting systems in place in MSs, e.g. the ability to investigate the evidence to support the link between human cases and the food vehicle. For example, the frequency of carrying out epidemiological investigations, such as cohort and case control studies may vary between countries.

The information on verified outbreaks in 2007 is very much dominated by the French data, which make the generalisation of results for the whole Community difficult.

Detailed reporting from verified outbreaks

The causative agent was identified in 69.3% of all reported verified food-borne outbreaks. Eleven MSs reported the causative agent for all verified outbreaks and eight MSs reported the majority of verified outbreaks with a causative agent. France and Spain accounted for 97.3% of all verified outbreaks reported without causative agent (Table EV1). However, these two MSs accounted for 73.0% of all reported verified outbreaks as well.

The type of outbreak (household or general) was reported in 98.6% of all verified outbreaks. However, the Netherlands only reported the type of outbreak for 43.2% of outbreaks (Table EV1). The type of outbreak is easily recordable and therefore most reports include this information.

For verified food-borne outbreaks it was possible to record various types of evidence supporting the food-borne origin of the outbreak; analytical epidemiological (e.g. statistical association between the food vehicle and human cases), laboratory detection in food or human cases or in both (e.g. causative agent or toxin), or laboratory characterisation (e.g. same serovar, phage type, or PFGE isolated both from the human cases and the food). Descriptive epidemiological evidence is pre-supposed when verified outbreaks are reported. If more than one type of evidence was observed, all relevant evidence could be reported to the database.

Type of evidence was reported in 74.3% of food-borne outbreaks, and only seven MSs did not include type of evidence for all verified outbreaks. However, two MSs – Denmark and Spain – reported the type of evidence only in a low proportion of their outbreaks (64.9% and 0.4% respectively) (Table EV1). According to the definition of verified outbreak, either isolation from the implicated foodstuffs or analytical epidemiological evidence is required before an outbreak can be reported as verified. However, this was only specified for 63.4% of verified outbreaks (Table EV1). In addition, only 'Laboratory detection in human cases' was selected in more than 200 outbreaks. It is obvious that the reporting guidelines for the verified food-borne outbreaks should be clarified in these aspects.

Table EV1. | ***Number of verified food-borne outbreaks specifying causative agent, type of outbreak and evidence, 2007***

Country	Causative agent		Type of outbreak		Type of evidence		
	Specified	Unspecified	Specified	Unspecified	Specified[1]		Unspecified
Austria	11	0	11	0	11	(11) (4)[2]	0
Belgium	21	0	21	0	21	(20)	0
Czech Republic	4	0	4	0	3	(3)	1
Denmark	57	0	57	0	37	(16)	20
Estonia	2	0	2	0	2	(2)	0
Finland	23	9	32	0	31	(23)	1
France	597	387	978	6	984	(857)	0
Germany	62	0	62	0	62	(62)	0
Hungary	50	2	52	0	51	(39)	1
Ireland	4	1	5	0	5	(4)	0
Latvia	15	0	15	0	15	(2)	0
Lithuania	7	3	10	0	10	(10)	0
Netherlands	37	0	16	21	37	(37)	0
Poland	154	1	154	1	152	(134)	3
Romania	37	0	37	0	36	(28)	1
Slovakia	17	0	17	0	17	(17)	0
Slovenia	16	1	17	0	17	(6)	0
Spain	277	218	495	0	2	(2)	493
Sweden	12	0	11	1	12	(10)	0
EU Total	**1,403**	**622**	**1,996**	**29**	**1,505**	**(1,283)**	**520**
Norway	29	0	29	0	29	(14)	0
Switzerland	7	0	7	0	7	(7)	0

1. In parenthesis is presented the number of verified outbreaks in compliance with the definition. The information should include descriptive epidemiological evidence and at least one of the following: laboratory detection of the causative agent in implicated food or analytical epidemiological evidence
2. The number of verified outbreaks with laboratory detection in implicated flock of animals (e.g. laying hens)

Information regarding human cases, hospitalisations and fatalities were provided for almost all outbreaks (Table EV2). Only eleven out of the 2,025 reported outbreaks (<1%) did not include information regarding the number of human cases.

The number of hospitalisations and case fatalities for individual verified outbreaks was given in 98.3% and 98.5% of all reports, respectively. Eight MSs did not include information regarding the number of hospitalisations, while four MSs did not include information regarding the number of case fatalities for all outbreaks (Table EV2). The Netherlands accounted for most of the reported outbreaks with no information on hospitalisations and case fatalities.

Table EV2. | ***Number of verified food-borne outbreaks specifying human cases, hospitalisations, and deaths, 2007***

Country	Human case data		Hospitalisation data		Death data	
	Specified	Unspecified	Specified	Unspecified	Specified	Unspecified
Austria	11	0	10	1	11	0
Belgium	21	0	21	0	21	0
Czech Republic	4	0	4	0	4	0
Denmark	57	0	56	1	56	1
Estonia	2	0	2	0	2	0
Finland	32	0	29	3	32	0
France	974	10	984	0	984	0
Germany	62	0	62	0	62	0
Hungary	52	0	51	1	52	0
Ireland	5	0	5	0	5	0
Latvia	15	0	14	1	15	0
Lithuania	10	0	10	0	10	0
Netherlands	37	0	23	14	23	14
Poland	154	1	153	2	152	3
Romania	37	0	37	0	37	0
Slovakia	17	0	17	0	17	0
Slovenia	17	0	17	0	17	0
Spain[1]	495	0	495	0	495	0
Sweden	12	0	1	11	0	12
EU Total	**2,014**	**11**	**1,991**	**34**	**1,995**	**30**
Norway	29	0	29	0	29	0
Switzerland	7	0	7	0	7	0

1. Spain reported aggregated data for all causative agents under the variable 'type of outbreak' (household or general). Therefore, detailed presentation of the number of cases was not possible

Information on implicated foodstuffs was provided in 68.8% of the verified outbreaks. In total, 11 MSs and one non-MS did not provide this information for all reported verified outbreaks. France and Spain accounted for the majority of reported verified outbreaks with missing information on implicated foodstuffs (69.8% and 24.2% respectively). These outbreaks were supported by epidemiological evidence in all but five outbreaks (Table EV3).

The origin of food gives information on whether the implicated foodstuff originated from a domestic market, intra-Community trade or was imported from outside the EU. This information was only reported in 16.4% of all reported verified outbreaks and only five MSs managed to report this for all outbreaks. France (all outbreaks) and Spain (all but two) included no information regarding the origin of foodstuff and thereby contributed 87.3% of all unknown values (Table EV3).

Information on contributing factors for verified outbreaks was reported for 35.8% of outbreaks. No MSs provided this information for all outbreaks except for Estonia, reporting two verified outbreaks in total (Table EV3).

Table EV3. | ***Number of verified food-borne outbreaks specifying foodstuffs implicated, origin of food, and contributing factors, 2007***

Country	Foodstuff implicated		Origin of food		Contributing factor	
	Specified	Unspecified	Specified	Unspecified	Specified	Unspecified
Austria	11	0	7	4	6	5
Belgium	21	0	13	8	12	9
Czech Republic	4	0	1	3	0	4
Denmark	50	7	14	43	14	43
Estonia	2	0	2	0	2	0
Finland	28	4	32	0	20	12
France	543	441	0	984	261	723
Germany	60	2	0	62	27	35
Hungary	52	0	41	11	12	40
Ireland	5	0	5	0	0	5
Latvia	6	9	15	0	13	2
Lithuania	9	1	9	1	8	2
Netherlands	35	2	3	34	13	24
Poland	153	2	141	14	100	55
Romania	37	0	37	0	32	5
Slovakia	17	0	3	14	2	15
Slovenia	7	10	1	16	15	2
Spain[1]	342	153	2	493	-	-
Sweden	11	1	7	5	10	2
EU Total	**1,393**	**632**	**333**	**1,692**	**547**	**983**
Norway	20	9	20	9	11	18
Switzerland	7	0	2	5	7	0

1. Spain reported aggregated data for all causative agents under the variable 'type of outbreak' (household or general). Number of outbreaks per specific food source was included as comments; however, the number of outbreaks per specific contributing factor could not be disaggregated

The setting (place of exposure) of the implicated foodstuff includes information regarding the location where the food was consumed or where the final stages of preparation of the suspect food took place (e.g. café/restaurant, institution, home, take-away outlet). This information was specified in 96.6% of reported outbreaks. Seven MSs and one non-MS reported verified outbreaks with unspecified settings, however, the majority of the unspecified settings were related to outbreaks reported by Spain (73.9%) (Table EV4).

The place of origin of the problem for the food-borne outbreak describes where the contamination or improper handling of the implicated food occurred and can be a different place than the setting. This information was reported in 9.7% of the verified outbreaks. Only Estonia, Romania, Sweden and Switzerland reported specified information on the place of origin for all outbreaks, whereas France, Germany and Poland did not report this type of information from any of the verified outbreaks (Table EV4).

Table EV4. | ***Number of verified food-borne outbreaks specifying setting and origin of problem, 2007***

Country	Setting		Place of origin of the problem	
	Specified	Unspecified	Specified	Unspecified
Austria	11	0	6	5
Belgium	21	0	14	7
Czech Republic	2	2	1	3
Denmark	52	5	22	35
Estonia	2	0	2	0
Finland	32	0	21	11
France	978	6	0	984
Germany	60	2	0	62
Hungary	52	0	42	10
Ireland	5	0	4	1
Latvia	14	1	11	4
Lithuania	10	0	3	7
Netherlands	37	0	16	21
Poland	153	2	0	155
Romania	37	0	37	0
Slovakia	17	0	1	16
Slovenia	17	0	3	14
Spain[1]	444	51	2	493
Sweden	12	0	12	0
EU Total	**1,956**	**69**	**197**	**1,828**
Norway	24	5	19	10
Switzerland	7	0	7	0

1. Spain reported aggregated data for all causative agents under the variable 'type of outbreak' (household or general). The number of outbreaks per specific setting was included as comments

Discussion | 6

MSs have had a legal obligation to report on food-borne outbreaks at Community level since 2005 and the data received in 2007 from MSs were generally complete and of high quality. A total of 5,609 outbreaks were reported which is a slight decrease of 2.2% compared to 2006. Countries reporting in 2007 were, apart from a few exceptions, the same as in 2005 and 2006.

In 2007, a new outbreak reporting system was implemented by MSs, and overall the reporting using the new system took place without major difficulties. The majority of the MSs were able to submit information by utilising the new reporting format and the numbers of the reported outbreaks were generally at the same level as in previous years. All MSs were encouraged to provide data in individual outbreak format, in order to avoid losing information due to data aggregation. In general, fewer MSs reported aggregated data in 2007 compared to previous years.

For almost all the verified outbreaks reported (>95%), type of outbreak, setting, the number of cases, hospitalisations and fatalities were reported. The causative agent, foodstuff implicated and type of evidence were specified in approximately 70% of the verified outbreaks. Seemingly, it was more difficult for the MSs to gather detailed information on contributing factors and origin of food for which less information was reported. Data on place of origin of the problem may also have been challenging to obtain, as this was reported for only 10% of the verified outbreaks.

Numbers of outbreaks reported

The great variation between the reporting MSs in the share of verified outbreaks reported was remarkable. Some big MSs such as the United Kingdom and Greece did not report any verified outbreaks, whereas France and Spain provided data on large numbers of outbreaks, all verified. Even though there might have been some different interpretations in the classification of the outbreaks between possible and verified, these results indicate that there are differences in MS ability to identify, investigate, combine information available and report food-borne outbreaks at national level. This is supported by the variation observed in the numbers of reported outbreaks per population between MSs. Therefore, it is likely that the MSs reporting the highest numbers of outbreaks are the countries having good systems for the investigation and reporting of food-borne outbreaks, rather than having a lower food safety situation.

Taking into account the great variation in the reporting of outbreaks, especially that of verified outbreaks, the data from 2007 is dominated by the information received from some MSs, mainly from France and Spain. Thus, the data is not likely to be fully representative of the whole Community.

Distinction between possible and verified outbreaks

For the purpose of overall analysis at Community level, it was deemed useful to make a distinction between reporting possible food-borne outbreaks and verified food-borne outbreaks on the basis of the evidence supporting the link between human cases and the food source.

In the new reporting system, possible food-borne outbreaks are defined in such a way as to include all outbreaks which might be caused by consumption of food, in order to study the overall extent and impact of food-borne outbreaks in the Community. In contrast, the definition of verified food-borne outbreaks is purposely rather strict, to stimulate the collection of limited good quality data for these outbreaks.

According to the definition of verified outbreaks, either isolates from the implicated food vehicle or analytical epidemiological evidence is required and this evidence was specified for 22.6% and 42.5% of the verified outbreaks, respectively. Since 2007 was the first year to implement this distinction of outbreaks, it is possible that some different interpretations were applied by the MSs in the classification and reporting. Therefore, it seems that this aspect of the reporting should be clarified further to the MSs.

In previous years, detailed information was requested for all outbreaks, whereas in 2007 these data were only requested for verified outbreaks. This means that these figures on the human disease burden in 2007 are not comparable to previous years. However, the data for 2007 represents outbreaks that are more likely to be of food-borne origin and therefore this information should give a more reliable picture of the burden coming from this source.

Observed results in the outbreaks

Even though the dataset may be biased due to few MSs providing most information, some interesting observations were made.

Overall, 39,727 human cases were reported in the 2,025 verified outbreaks, and the greatest number of cases were caused by *Salmonella* (8,922).

Salmonella was by far the most commonly reported causative agent of food-borne outbreaks, as in previous years, with *S*. Enteritidis as the dominant *Salmonella* serovar. As *S*. Enteritidis is often associated with eggs and egg products this corresponds well with the fact that eggs and egg products, as well as bakery products using raw eggs were the most common food vehicles associated with outbreaks. An interesting result was that the proportion of broiler and poultry meat as a food vehicle seems to be lower in 2007 compared to previous years. The number of reported *Salmonella* outbreaks in the EU decreased compared to 2005 and 2006, but this change seemed to be mainly due to two MSs.

Food-borne viruses were, as in 2006, reported as the second most common known cause of food-borne outbreaks in the EU. However, outbreaks caused by food-borne viruses are often difficult to investigate, both microbiologically and epidemiologically, and therefore the source of infection is often classified as suspected or unknown. In previous years, it has been assumed that the number of food-borne outbreaks caused by viruses was underreported, and it is therefore encouraging to see more virus outbreaks being reported. The use of the Kaplan criteria (Kaplan *et al*, 1982[18]) might help in identifying norovirus outbreaks.

Campylobacter and bacterial toxins caused by *Staphylococcus*, *Bacillus* and *Clostridium* also caused substantial numbers of outbreaks in 2007. An infected food handler was an important contributory factor in outbreaks caused by *Staphylococcus*.

Few verified parasitic food-borne outbreaks were reported in 2007. However, Romania and Poland reported a number of *Trichinella* outbreaks with a substantial number of cases hospitalised. One tick-borne encephalitis (TBE) outbreak caused by flavivirus was reported from Hungary. The outbreak was caused by the consumption of raw milk from a goat with acute TBE.

Waterborne outbreaks may potentially be large, especially if the public drinking water supply is contaminated, and for the 17 waterborne outbreaks reported for 2007, on average, more than 600 human cases were involved per outbreak.

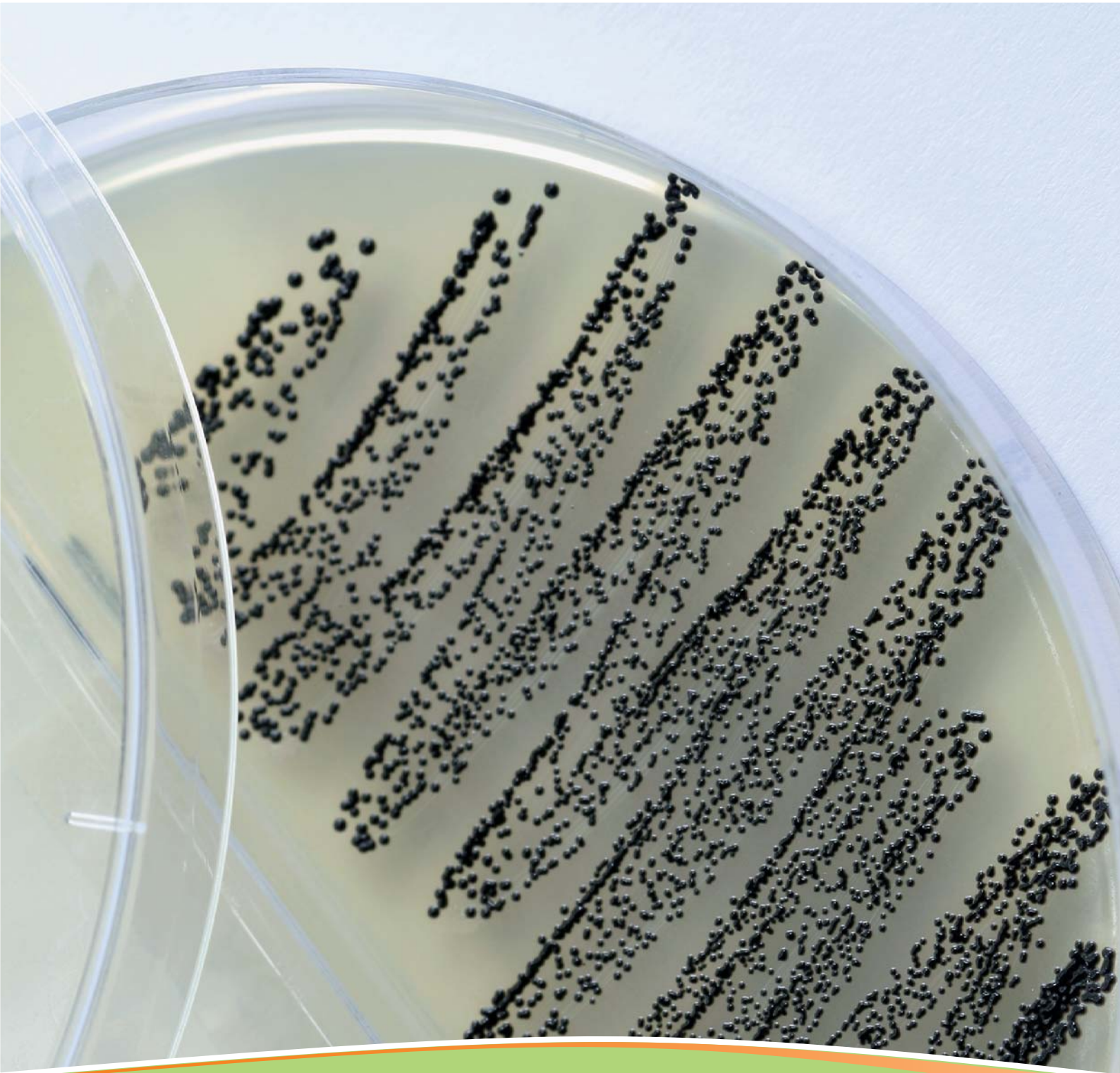
Aggregated data

All MSs were encouraged to provide data in individual outbreak format, in order to avoid losing information due to data aggregation. In general, fewer MSs reported aggregated data in 2007 compared to previous years. Aggregation of outbreaks based on causative agent and type of outbreaks, prevents the ability to attribute the specific number of outbreaks and human cases to the reported descriptive parameters (food vehicle, setting, origin of food etc.). Some MSs included a comment on the number of outbreaks per implicated foodstuff and settings, and after re-coding these data could be included in the figures. It is therefore important for MSs to be aware of the consequences of submitting aggregated data, when reporting in the new system. However, aggregation may be an appropriate option where little information is available and where the same causative agent is either shared or unknown.

18. Kaplan, J.E., Gary, G.W., Baron, R.C., Singh, N., Schonberger, L.B., Feldman, R., Greenberg, H.B. 1982. Epidemiology of Norwalk gastroenteritis and the role of Norwalk virus in outbreaks of acute nonbacterial gastroenteritis. *Ann Intern Med*. 96,756–61.

Conclusion

In order to control or prevent future food-borne outbreaks, knowledge of sources and transmission routes of infections are essential. Therefore, compiling and sharing this information amongst MSs is beneficial. In this respect, the Community reporting system on outbreaks provides relevant and useful information. However, there are still a number of differences in how MSs investigate and report outbreaks, even through the new reporting system, which sometimes makes it difficult to compare and analyse the data available. In order to improve further the information available, EFSA and ECDC, in collaboration with the Commission, intend to carry out a critical review of the results from the reporting of food-borne outbreaks for the years 2007-2008 in the EU and to evaluate the reporting system in the light of that data. Enhanced reporting of the national datasets would strengthen conclusions made based on the data and would give an even more representative picture of the overall situation in the Community.



Materials and methods | 7

The Zoonoses Directive 2003/99/EC requires MSs to collect, evaluate and report data on zoonoses, zoonotic agents, antimicrobial resistance and food-borne outbreaks on an annual basis. EFSA has established a web-based reporting system to streamline and harmonise the reporting.

The Report from the Task Force on Zoonoses Data Collection on harmonising the reporting of food-borne outbreaks through the Community reporting system in accordance with Directive 2003/99/EC (adopted by the Task Force on 8 November 2007), lays down the basis for the new reporting system implemented for the first time in the reporting of data from 2007. A manual for reporting food-borne outbreaks with detailed descriptions on the requirements and definitions was also provided to support MS reporting.

Each MS provides information on the national reporting system and if possible, additional details of verified outbreaks of special interest in a free text form. Further, information on total number of outbreaks and detailed information on verified outbreaks are provided in table forms with drop down menus.

7.1 | National reporting system

Each MS should specify the national system in place for the identification, epidemiological investigation and reporting of food-borne outbreaks for a better understanding of reported data.

Typically this text briefly describes:

- procedures for investigation and reporting (including frequency of reporting) of food-borne outbreaks and their legal basis,
- any relevant changes in the reporting system in comparison with previous year(s),
- differences in the definitions used and in the scope of the system as compared with the Community system (e.g. if the national reporting system does not allow a distinction to be made between general and household outbreaks),
- the authorities and institutions involved: their roles and mutual co-ordination.

The web database automatically copies the information provided in this text form from the previous year's report so the reporting officer only needs to update the free text where appropriate.

7.2 | Number of food-borne outbreaks

Information on the total number of food-borne outbreaks (including both possible and verified food-borne outbreaks) and the total number of verified food-borne outbreaks that occurred during the reporting year is provided by MSs. For possible food-borne outbreaks, the causative agent should be noted; this is the only information to be collected on possible food-borne outbreaks. For the verified food-borne outbreaks, an additional table is available to collect more detailed information.

All food-borne outbreaks that have their onset during the reporting year should be reported. Preferably the onset of the outbreak is defined as the onset of symptoms in the first reported case, but alternative definitions by MSs can be accepted. Some MSs do not record the earliest date of onset but the reporting date instead and may use the reporting date to define the onset of the outbreak. Alternative definitions should be specified under the description of the national reporting system.

7.3 | Information to be reported for verified food-borne outbreaks

In order to balance feasibility and the need for detailed information, MSs were asked to submit data on a limited number of variables for verified food-borne outbreaks (in line with the definition of the Zoonoses Directive as specified earlier). Detailed information from possible outbreaks should not be reported in this table. Information on the pick lists for the variables is included in Appendix II.

The web application will allow the input of data both in individual outbreak format and in aggregated format (where all food-borne outbreaks related to the same variable are reported in one row), e.g. based on the causative agent and/or in accordance with food vehicle, setting, or place of origin of the problem. MSs are encouraged to provide the data on individual outbreaks in order to avoid losing information because of data aggregation. Aggregated data will be presented in overview tables only, since such data will not allow more detailed analysis.

7.4 | National evaluation of the reported food-borne outbreaks

Inclusion of information on the national evaluation of the reported food-borne outbreaks is envisaged in the Zoonoses Directive. This is required to ensure that the data submitted by MSs is correctly interpreted at Community level.

Typically this text briefly describes the:

- the trend in the number of food-borne outbreaks and possible underlying reasons,
- relevance of the different causative agents, food categories and the agent/food category combinations,
- relevance of different types of place of food production and preparation in food-borne outbreaks,
- evaluation of the severity of human cases (e.g. trends in the number of hospitalisations and deaths),
- measures or other actions taken to control or prevent food-borne outbreaks.

Appendices | 8

8.1 | Appendix I: Definitions

For the purpose of this report, the following definitions will apply:

Analytical epidemiological evidence: evidence of a statistically significant association between a food item (foodstuff) and the human cases in the food-borne outbreak demonstrated by either a cohort study or a case-control study.

Causative agent: the agent considered to be the cause of the food-borne outbreak(s) and typically the one detected in the people affected and/or in the implicated food.

Contributory factor: factor that contributed to the occurrence of the food-borne outbreak. This may include deficiencies in food handling or the use of contaminated materials.

Descriptive epidemiological evidence: information linking two or more people with clinical symptoms consistent with a disease caused by the same pathogen, with a possible food vehicle in common.

Food-borne outbreak: *"an incidence, observed under given circumstances, of two or more human cases of the same disease and/or infection, or a situation in which the observed number of human cases exceeds the expected number and where the cases are linked, or are probably linked, to the same food source"* (Directive 2003/99/EC).

- Verified food-borne outbreak includes outbreaks compatible with descriptive epidemiological evidence and at least one of the following: laboratory detection of the causative agent in implicated food or analytical epidemiological evidence.
- Possible food-borne outbreak includes outbreaks compatible with descriptive epidemiological evidence alone including also outbreaks where the causative agent is unknown.

Food (or foodstuff): *any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be, ingested by humans* (Reg. (EC) No 178/2002). This definition includes drinking water (Reg. (EC) No 178/2002) and covers single food items as well as composite meals.

General outbreak: food-borne outbreak involving human cases from more than one household. Outbreaks in residential homes (e.g. nursing homes), schools, and other similar institutions are considered to be general outbreaks.

Household outbreak: food-borne outbreak involving human cases living in one household.

Outbreak cases: The number of human cases involved in the food-borne outbreak as defined by the investigators. This can include people with asymptomatic infections. Case definitions for human cases for most common zoonotic infections have been established by ECDC and are available at www.ecdc.europa.eu.

Laboratory detection: detection of the potential causative agent or toxin or bio-active amine in clinical samples or in a food sample taken in the course of the investigation.

Laboratory characterisation: characterisation of the causative agent(s) and/or toxins to the level (of speciation, sub-typing (e.g. sero- / phage- / ribo-typing), or Pulsed Field Gel Electrophoresis (PFGE) profile) needed to link the human cases to each other and to the implicated foodstuff.

Setting: place of exposure to the implicated foodstuff. This is the location where the food was consumed or where the final stages of preparation of the suspect food took place (e.g. café/restaurant, institution, home, take-away outlet).

Place of origin of problem: place other than the setting where the contamination or improper handling of the implicated food occurred.

8.2 | Appendix II: Pick lists for information on verified outbreaks

A. | *Causative agent list*

This list provides the most commonly reported agents but is not exhaustive. The reporting system allows the adding of other agents and provides deeper levels for a breakdown of species / serovars / serotypes / phage types.

Adenovirus	Flavivirus
Aeromonas	*Giardia*
Aichivirus	Hepatitis virus
Anisakis	Histamine
Astrovirus	*Listeria*
Bacillus	Marine biotoxins
Brucella	Mushroom toxins
Calicivirus (including norovirus)	Mycotoxins
Campylobacter, thermophilic	Rotavirus
Clostridium	*Salmonella*
Cryptosporidium	*Sarcocystis*
Cysticerci	*Shigella*
Diphyllobothrium	*Staphylococcus*
Enterobacter	*Trichinella*
Enterovirus	Unknown
Erysipelothrix	*Vibrio*
Escherichia coli, pathogenic	*Yersinia*

B. | *Foodstuff implicated (food vehicle involved)*

Code	Decode
01	Milk
02	Dairy products (other than cheeses)
03	Cheese
04	Eggs and egg products
05	Bovine meat and products thereof
06	Pig meat and products thereof
07	Sheep meat and products thereof
08	Other or mixed red meat and products thereof
09	Broiler meat (*Gallus gallus*) and products thereof
10	Turkey meat and products thereof
11	Other or unspecified poultry meat and products thereof
12	Fish and fish products
13	Crustaceans, shellfish, molluscs and products thereof

Code	Decode
14	Vegetables and juices and other products thereof
15	Canned food products
16	Cereal products including rice and seeds / pulses (nuts, almonds)
17	Fruit, berries and juices and other products thereof
18	Drinks, including bottled water
19	Tap water including well-water
20	Sweets and chocolate
21	Bakery products
22	Herbs and spices
23	Mixed or buffet meals
88	Other foods
99	Unknown

C. | *Setting*

Code	Decode
01	Household
02	Restaurant / café / pub / bar / hotel
03	Mobile retailer / market / street vendor
04	Take-away or fast food outlet
05	Canteen or workplace catering
06	Hospital / medical care facility
07	Residential institution (nursing home, prison, boarding schools)
08	School, kindergarten
09	Temporary mass catering (fairs, festivals)
10	Camp, picnic
11	Aircraft / ship / train
88	Other
99	Unknown

D. | *Place of origin of problem*

Code	Decode
01	Travel abroad
02	Slaughterhouse
03	Farm (primary production)
04	Processing plant
05	Retail sale outlet
06	Catering services / restaurant
07	Take-away
08	Household / domestic kitchen
09	Transport
10	Water treatment plant
11	Water distribution system
12	Water source
88	Other
99	Unknown

E. | *Contributory factor*

Code	Decode
01	Unprocessed contaminated ingredient
02	Storage time / temperature abuse
03	Inadequate heat treatment
04	Inadequate chilling
05	Cross-contamination
06	Infected food handler
07	Water treatment failure
88	Other
99	Unknown

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