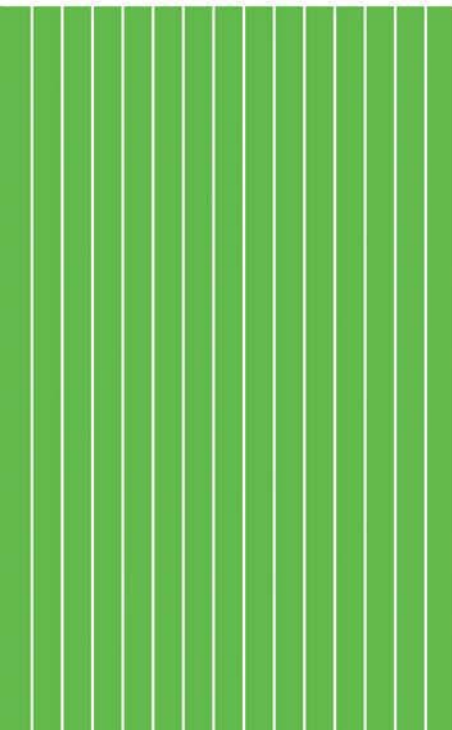
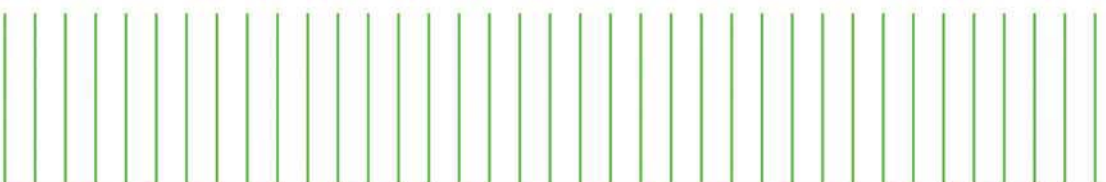


## NORWAY

### TRENDS AND SOURCES OF ZONOTIC AGENTS IN HUMANS, FOODSTUFFS ANIMALS AND FEEDINGSTUFF

- including information on foodborne outbreaks, antimicrobial resistance in zoonotic agents and some pathogenic microbiological agents

In 2011



# Norway

## Trends and sources of zoonoses and zoonotic agents in humans, foodstuffs, animals and feedingstuffs

- including information on foodborne outbreaks, antimicrobial resistance in zoonotic agents and some pathogenic microbiological agents

### In 2011

The Report referred to in Article 9 of Directive 2003/99/EC

# Information on the reporting and monitoring system

Country: Norway  
Reporting Year: 2011

## Institutions and laboratories involved in reporting:

### The Norwegian Food Safety Authority (NFSA)

The Norwegian Food Safety Authority (NFSA) is the competent authority for the purpose of Directive 2003/99/EC of the European Parliament and of the Council.

### The Norwegian Veterinary Institute (NVI)

The Norwegian Veterinary Institute (NVI) is a governmental agency funded by the Ministry of Agriculture and Food, Ministry of Fisheries and Coastal Affairs and the Norwegian Research Council. The primary function is the supply of independent research based advisory support to the governing authorities regarding animal health, fish health and food safety.

The reporting officer is employed at NVI.

### The National Institute of Nutrition and Seafood Research (NIFES)

The National Institute of Nutrition and Seafood Research (NIFES) is a research institute with administrative tasks. The institute is linked directly to the Ministry of Fisheries and Coastal Affairs and act as an advisor to the Ministry in matters concerning the "fjord to fork" production chain of seafood (both wild and farmed). NIFES also provides independent and research based advisory support to other governmental bodies and to the Norwegian fisheries and aquaculture industries.

### The Norwegian Institute of Public Health (NIPH)

The Norwegian Institute of Public Health (NIPH) is the national governmental centre for communicable disease prevention and control. The institute performs research and surveillance of communicable diseases in man and advises governmental and municipal authorities and the public on the prevention of communicable diseases, outbreaks and antimicrobial resistance. The institute also has responsibilities concerning chronic disease epidemiology, environmental medicine and forensic toxicology.

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## Preface

This report is submitted to the European Commission in accordance with Article 9 of Council Directive 2003/99/EC<sup>1</sup>. The information has also been forwarded to the European Food Safety Authority (EFSA) and to the EFTA Surveillance Authority (ESA).

The report contains information on trends and sources of zoonoses and zoonotic agents in Norway during the year 2011. The information covers the occurrence of these diseases and agents in humans, animals, foodstuffs and for *Salmonella* also feedingstuffs. In addition the report includes data on antimicrobial resistance in some zoonotic agents and commensal bacteria as well as information on epidemiological investigations of foodborne outbreaks. Complementary data on susceptible animal populations in the country is also given. The information given covers both zoonoses that are important for the public health in the whole European Community as well as zoonoses, which are relevant on the basis of the national epidemiological situation.

The report describes the monitoring systems in place and the prevention and control strategies applied in the country. For some zoonoses this monitoring is based on legal requirements laid down by the Community Legislation, while for others national requirements are applied.

The report presents the results of the examinations carried out in 2011. A national evaluation of the epidemiological situation, with special reference to trends and sources of zoonotic infections, is given. Whenever possible, the relevance of findings in foodstuffs and animals to zoonoses cases in humans is evaluated.

The information covered by this report is used in the annual Community Summary Report on zoonoses that is published each year by EFSA.

<sup>1</sup>Directive 2003/99/EC of the European Parliament and of the Council of 12 December 2003 on the monitoring of zoonoses and zoonotic agents, amending Decision 90/424/EEC and repealing Council Directive 92/117/EEC, OJ L 325, 17.11.2003, p. 31

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## Animal populations

The relevance of the findings on zoonoses and zoonotic agents has to be related to the size and nature of the animal population in the country.

### Sources of information

Data on herds and animals: Register of Production Subsidies.

Data on slaughtered animals: Register of Slaughtered Animals.

### Dates the figures relate to and the content of the figures

Data on herds and animals: As of 31 July 2011.

### Definitions used for different types of animals, herds, flocks and holdings as well as the types covered by the information

Herd means an animal or group of animals kept on a holding as an epidemiological unit (article 2.3(a) of Regulation (EC) No 2160/2003). In Norway, there is generally only one herd of the same animal species per holding.

A flock (poultry) is defined as all poultry of the same health status kept on the same premises or in the same enclosure and constituting a single epidemiological unit; in the case of housed poultry, this includes all birds sharing the same airspace (article 2.3(b) of Regulation (EC) No 2160/2003).

### National evaluation of the numbers of susceptible population and trends in these figures

For cattle, swine, sheep, goat and poultry (layers and broilers) there has been a downward trend in the number of herds/holdings during the last decade. However, the average number of animals per herd/holding has increased.

### Geographical distribution and size distribution of the herds, flocks and holdings

*Cattle:* Most of the cattle herds are dairy herds, the average herd size being 22.1 cows. There are also a number of specialized beef herds with an average number of suckling cows of 15.1. A few herds are combined dairy and beef herds. The cattle herds are distributed throughout Norway with the main part being in the western and middle parts of Norway.

*Swine:* In Norway there are about 2300 swine herds which produce about 1.6 million fattening pigs per year. The swine herds are scattered all over the country, but most of the pig production (about 60%) are located in four of the 20 counties. The pig population is organized in a breeding pyramid with 44 approved nucleus breeding herds and 60 approved multiplier herds. More than 95% of the marketed breeding animals are purchased from these herds.

*Sheep:* The Norwegian sheep flocks are widely distributed over the country, with the largest population found in the southwest. The sheep population consists of combined meat and wool producing breeds, with various Norwegian breeds predominating.

*Goat:* The Norwegian goat population is principally composed of one Norwegian breed. The main product is milk used for cheese production. The goat flocks are located in some mountainous regions in the southern part of the country, in the fjord districts of the western part, and in the northern counties.

*Poultry:* The Norwegian poultry production has a hierarchical structure and is strictly regulated. Egg and broiler meat production are the most important branches, but the number of holdings keeping turkey and other species is increasing. The Norwegian layer population consists of two strains (Lohmann white and Shaver white). The layer population is located throughout Norway. The commercial broiler production consists of one strain (Ross). The broiler production is mainly located in five counties in the southern and middle part of Norway.

### Additional information

The livestock production in Norway is targeted for the national market. Until 1999 there was a general ban on the import of live animals and animal products to Norway. Following the extension of the European Economic Area (EEA) Agreement 1 January 1999 regarding Veterinary and Phytosanitary matters, the general ban was lifted. However, imports of live animals remained limited.

Table Susceptible animal population

	Number of holdings (flocks) <sup>1</sup>	Livestock numbers (live animals) <sup>1</sup>	Number of slaughtered animals <sup>2</sup>
<b>Cattle</b>			
Dairy cows and heifers	9,600	209,000	
Mixed herds	920	32,600	
Meat production animals	4,200	63,400	
In total	16,100	862,000	289,500
<b>Deer</b>	83	7,700	
<b>Gallus gallus (fowl)</b>			
Grandparent breeding flocks – egg production line	2 (4)		
Parent breeding flocks – egg production line <sup>3</sup>	11 (19)		
Grandparent breeding flocks – meat production line	1 (1)		
Parent breeding flocks – meat production line <sup>3</sup>	70 (140)		
Laying hens <sup>4</sup>	580 (830)	3,778,000	941,000
Broilers	590 (4700)		62,950,000
<b>Goats</b>			
Milk goats	380	35,400	
In total	1,300	66,900	20,100
<b>Pigs</b>			
Breeding animals	1,300	56,000	
Fattening pigs	2,100	460,000	
In total	2,300	839,000	1,589,000
<b>Sheep</b>			
Animals over 1 years	14,500	882,000	
In total	14,600	2,291,000	1,187,000
<b>Horses</b>			1,600
<b>Turkeys, ducks and geese</b>			
Parent breeding flocks <sup>3</sup>	9 (21)		
In total	52 <sup>5</sup>	371,000	1,420,000

Numbers between 100 and 1000 rounded to the nearest ten, numbers >1000 rounded to the nearest hundred.

<sup>1</sup> Register of Production Subsidies as of 31.07.2011

<sup>2</sup> Register of Slaughtered Animals.

<sup>3</sup> Only production flocks.

<sup>3</sup> Only flocks >250 birds.

<sup>3</sup> Only flocks >25 birds.

# Salmonellosis

## *General evaluation of the national situation*

### History of the disease and/or infection in the country

The situation regarding *Salmonella* in feedingstuffs, animals and food produced in Norway has for many years been very good. Approximately 75-80% of the cases of salmonellosis in humans are acquired abroad.

### National evaluation of the recent situation, the trends and sources of infection

There is no alarming development in the number of salmonellosis cases in humans, neither for domestic nor imported cases. However, there seem to be have been a slightly increasing trend in domestic infections during the last decade.

For feedingstuffs and animals, the situation is very good and has been so for many years. Regarding food, the food produced in Norway is virtually free from *Salmonella*. Risk of exposure is mainly associated with international trade in food.

### Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases

The Norwegian *Salmonella* Control Programmes have documented that live cattle, swine, and poultry in Norway as well as domestically produced food products of animal origin are virtually free from *Salmonella*. Each year, approximately 75-80% of reported cases of salmonellosis in humans have acquired the infection abroad. This illustrates that domestic food products of animal origin represent a small risk to the consumer in regard to *Salmonella*, an assumption that is supported by case control studies.

## *Salmonellosis in humans*

### Reporting system in place for the human cases

Human cases are reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), from microbiological laboratories as well as from clinical doctors. The system distinguishes between domestic and imported cases. The severity of the disease at the time of reporting is also recorded. However, the surveillance system does not follow individual patients over time to record further disease development and final outcome.

### Case definition

A case from which *Salmonella* other than *S. Typhi* and *S. Paratyphi* has been isolated or a clinical compatible case with either an epidemiological link to a culture confirmed case or serology indicating recent infection.

### Diagnostic/analytical methods used

Bacteriology (isolation of the agent from a clinical sample) followed by confirmation, including serotyping and sometimes genotyping, at the National Reference Laboratory.

### Notification system in place

According to the Communicable Disease Act, human cases are notifiable to the Norwegian Surveillance System for Communicable Diseases (MSIS) since 1975.

### History of the disease and/or infection in the country

The recorded incidence of salmonellosis in Norway has increased during the last three decades with a sharp rise in the early 1980s due to the emergence of *S. Enteritidis*. In the majority of cases of salmonellosis (approximately 80%), the patients have acquired the disease abroad. The number of reported cases of salmonellosis corresponds well with charter tourism to foreign countries; in years with an increased charter tourism, such as in the mid-1980s and in the period 1992-1998, the incidence of salmonellosis also increased, whereas in years with a lower charter tourism activity due to economical depression, such as in the period 1988-1991, the incidence of salmonellosis dropped.

Since 1998, the incidence of salmonellosis has levelled off. However, an increase was noted during 2001, mostly due to a few large outbreaks. Since 1984, *S. Enteritidis* has become the most common serovar reported, except in 1987 when it was surpassed by *S. Typhimurium* due to a domestic outbreak traced to contaminated chocolate bars. While *S. Typhimurium* predominated in earlier years, *S. Enteritidis* has increased substantially from a low level in 1975-1982 to a higher level from the mid-1990s. No increase of similar magnitude has been observed for any other serovar. The proportion of imported cases of



*S. Enteritidis* infections is particularly high (approximately 90% among patients with known place of acquisition) as this pathogen is not established in the Norwegian poultry production. Among domestic cases, *S. Typhimurium* is the most common serovar. This serovar, although not established among food producing animals in Norway, does occur in the Norwegian environment such as in wild birds and hedgehogs.

#### Results of the investigation

In 2011, a total of 1290 cases of salmonellosis were reported (incidence rate 26,2 per 100 000), of which 311 (24%) were infected in Norway. Altogether 494 (38%) of the cases were due to *S. Enteritidis*, of which 44 (9%) were infected in Norway. Altogether, 182 (14%) of the cases were due to *S. Typhimurium*, of which 98 (54%) were domestic cases. During the past years monophasic *S. Typhimurium* has been increasingly implicated in human disease. In 2011 a total of 157 cases of monophasic *S. Typhimurium* were reported, of which 64 (21%) were infected in Norway.

In 2011 only one small outbreak of salmonellosis was recorded in Norway. It was among a small group of travellers to Tanzania.

#### National evaluation of the recent situation, the trends and sources of infection

There was a decrease in the overall number of Salmonella-infections in 2011. Most of the reduction is in the number of patients who have contracted the infection abroad.

For domestically acquired infections, 2006 and 2007 were record years when nearly 400 cases contracted salmonellosis inside Norway, - the highest recorded number since 1987. However, both in 2008 and in 2009, there has been a decrease in the number of patients who get the infection without travelling prior to getting ill. This decrease is probably linked to the decrease in cases who contract salmonellosis abroad, since we assume that a number of the domestic cases are secondary cases to imported infections.

#### Relevance as zoonotic disease

The Norwegian Salmonella Control Programmes have documented that live cattle, swine, and poultry in Norway as well as domestically produced food products of animal origin are virtually free from Salmonella. Each year, approximately 75-80% of reported cases of salmonellosis in humans have acquired the infection abroad. This illustrates that domestic food products of animal origin represent a small risk to the consumer in regard to Salmonella, an assumption that is supported by case-control studies.

However, data show that *S. Typhimurium* occurs endemically in the environment representing a risk for spread through wild animals and untreated water. In defined areas, where an endemic situation in the hedgehog and passerine bird populations has been established, annually minor outbreaks and sporadic cases occur.

#### Additional information

Patients whose work represents a risk for spread of the disease, e.g., in food production and health care, are advised to stay away from work as long as they have symptoms. It is recommended that for these patients three consecutive faecal samples examined after the symptoms have disappeared should be negative before resuming work.

Table Most common Salmonella serovars according to place of infection, data from MSIS 2011.

Serovar	Place of infection				Total	
	Norway	Abroad	Unknown	Total		
<i>S. Enteritidis</i>	44	14%	394	49%	56	494
<i>S. Typhimurium</i>	98	31%	62	8%	22	182
<i>S. Sp Ssp I Gr O:4 monofasic variant</i>	64	21%	72	9%	21	157
<i>S. Stanley</i>	10	3%	33	3%	9	52
<i>S. Saintpaul</i>	4	1%	17	2%	3	24
<i>S. Newport</i>	7	2%	12	1%	2	21
<i>S. Heidelberg</i>	2	1%	13	2%	4	19
<i>S. Java</i>	6	2%	8	1%	4	18
<i>S. Virchow</i>	2	1%	14	2%	1	17
<i>S. Infantis</i>	3	1%	13	2%	1	17
Others	71	23%	167	21%	51	289
<b>Total</b>	<b>311</b>	<b>100%</b>	<b>805</b>	<b>100%</b>	<b>174</b>	<b>1290</b>

## Salmonella in foodstuffs

### A. *Salmonella* spp. in eggs and egg products

Eggs and egg products are monitored indirectly by monitoring of the layer population - see chapter on *Salmonella* spp. in animals. Additional testing of egg products is carried out by the food business operators as an integral part of their own check procedures.

### B. *Salmonella* spp. in poultry meat and products thereof

Poultry meat and products thereof are monitored indirectly by testing all poultry flocks before slaughter - see chapter on *Salmonella* in animals. Additional testing at the slaughterhouses or cutting plants is not required. Surveys are performed occasionally.

### C. *Salmonella* spp. in red meat (pig, cattle) and products thereof

#### Monitoring system

*At slaughterhouse and cutting plant:* The Norwegian *Salmonella* Control Programme: Each year, a number of carcass swabs and lymph node samples are collected randomly from the animal population (pig, cattle) by slaughter and proportional to the slaughterhouses' throughput. The sampling of carcass swabs is described in this chapter, while the sampling of lymph nodes is described in the chapter on *Salmonella* in animals. Samples of crushed meat are each year collected according to production capacity of cutting plants.

*At meat processing plant:* Sampling according to Commission Regulation (EC) No 2073/2005 and Regulation (EC) No 853/2004 of the European Parliament and of the Council.

#### Frequency of the sampling

*At slaughterhouse:* Detection of an annual prevalence of 0.1% by 95% confidence level.

*At cutting plant:* According to production capacity: less than 2 tons: twice a year, 2-20 tons: once a month, greater than 20 tons: once a week.

*At meat processing plant:* According to Regulation 2073/2005. The frequencies may, however, vary according to the origin of the raw material and the demonstrated regional or national salmonella prevalence in the corresponding animal populations.

#### Type of specimen taken

*At slaughterhouse:* Surface of carcass.

*At cutting plant:* Crushed meat from equipment or trimmings.

*At meat processing plant:* Minced meat or meat preparations.

#### Methods of sampling (description of sampling techniques)

*At slaughterhouse:* The upper inner part of the hind legs/pelvic entrance and the cut surface area of the abdomen and chest are swabbed, covering an area of approximately 1400 cm<sup>2</sup> of each carcass.

*At cutting plant:* Each sample consists of 25 grams of meat.

*At meat processing plant:* Each sample consists of 25 grams of minced meat or meat preparations.

#### Definition of positive finding

A positive sample is a sample from which *Salmonella* has been isolated.

#### Diagnostic/analytical methods used

Bacteriological method: NMKL No 71:1999

#### Control program/mechanisms/notification system in place

The Norwegian *Salmonella* Control Programme is mandatory. Detection of *Salmonella*, irrespective of serovar, is notifiable.

#### Measures in case of the positive findings or single cases

Whenever *Salmonella* is detected in samples taken in the National Control Programmes, the competent authorities must be notified without delay. Actions will be taken to identify and eliminate the source of the contamination in order to prevent further spread. However, in the sheep population in some regions, *S. diarizonae* is endemic. When this serovar is detected in sheep, less extensive measures are carried out.

When *Salmonella* is detected in food already on the market, contaminated food will be withdrawn from the market and destroyed or, exceptionally, submitted to processing by a treatment eliminating the hazard. Investigation into the source of the contamination is initiated if relevant. If *Salmonella* is

detected in food controls at the Border Inspection Posts, the consignments will be either rejected or destroyed or, exceptionally, submitted to processing by a treatment eliminating the hazard.

#### Results of the investigation

##### Pig meat

In 2011, a total of 2212 carcasses were swabbed, all were negative.

##### Cattle meat

In 2011, a total of 1799 carcasses were swabbed, all were negative

##### Crushed red meat

In 2011, one out of 2582 samples of crushed red meat (cattle, pigs, sheep) was positive for *S. enterica* subsp. *enterica* 4,12:i:-.

#### National evaluation of the recent situation, the trends and sources of infection

The Norwegian *Salmonella* Control Programmes document that domestically produced food products of animal origin are virtually free from *Salmonella*. The surveillance data indicate that the overall prevalence is below 0.1%.

#### Relevance of the findings in animals to findings in foodstuffs and to human cases

Red and white meat produced in Norway is virtually free from *Salmonella*, and the risk of contracting *Salmonella* from domestically produced animal products is small. A connection between meat or meat products of domestic origin and human infection has never been established.

Table *Salmonella* in foodstuffs

	Source of information	Sample weight	Units tested	Total units positive for <i>Salmonella</i> spp.
Pig - carcass swabs	NSCP <sup>1</sup>	swab	2212	0
Cattle - carcass swabs	NSCP	swab	1799	0
Crushed red meat (pig, cattle, sheep)	NSCP	25g	2582	1*
Fish - wild catch	NIFES	25g	70	0
Fish – imported products	NIFES	25g	122	0
Molluscan shellfish - raw	NIFES	25g	44	0

<sup>1</sup>NSCP = Norwegian *Salmonella* Control Programme

\* *S. enterica* subsp. *enterica* 4,12:i:-

## Salmonella in animals

### A. *Salmonella* spp. in poultry (*Gallus gallus*, turkeys, ducks, geese, guinea fowls)

#### Monitoring system

##### Breeding flocks

The Norwegian *Salmonella* Control Programme established pursuant to Article 5 of Regulation (EC) 2160/2003 and approved by the EFTA Surveillance Authority (ESA) (364/07/COL) includes all poultry breeding flocks. Sampling takes place at the initiative of the food business operator and by the Competent Authority according to Regulation (EC) 1003/2005 and Regulation (EC) 200/2010 (replaced 1003/2005 in July 2011). The Norwegian *Salmonella* Control Programmes also include all breeder flocks of ducks, geese, turkeys and guinea fowl.

Other strategies: Animals are tested in relation to clinical surveillance and import. Norway is also granted additional guarantees according to Commission decision 2003/644/EC.

##### Laying hens flocks

The Norwegian *Salmonella* Control Programme: All laying hen flocks are tested at the farm. Sampling takes place at the initiative of the food business operator and by the Competent Authority according to Regulation (EC) 1168/2006.

Other strategies: Animals are tested in relation to clinical surveillance and import. Additional guarantees according to Commission decision 2004/235/EC also applies to Norway.

##### Meat producing flocks (broilers, turkeys, ducks, geese, guinea fowl)

The Norwegian *Salmonella* Control Programme: All poultry flocks are tested before slaughter. Sampling takes place at the initiative of the food business operator and once a year by the Competent Authority according to Regulation (EC) 646/2007. If poultry for slaughter are imported, additional guarantees according to 95/410/EC applies.

#### Frequency of the sampling

##### Breeding flocks

*Day-old chicks*: Every flock is sampled.

*Rearing period*: Every flock is sampled twice.

*Production period*: Every second week.

##### Laying hens

*Day-old chicks*: Every flock is sampled.

*Rearing period*: 2 weeks prior to moving.

*Production period*: Every 15 weeks.

*Before slaughter at farm*: Every flock for slaughter is sampled.

##### Meat producing flocks (broilers, turkeys, ducks, geese, guinea fowl)

*Before slaughter at farm*: Every flock is sampled

#### Type of specimen taken

##### Breeding flocks

*Day-old chicks*: Internal linings of delivery boxes.

*Rearing period*: Socks/boot swabs.

*Production period*: Socks/boot swabs or faeces (caged birds) and dust swabs.

*Before slaughter at farm*: Socks/boot swabs or faeces (caged birds) and dust swabs.

##### Laying hens

*Day-old chicks*: Internal linings of delivery boxes.

*Rearing period, production period*: Socks/boot swabs or faeces (caged birds).

*Before slaughter at farm*: Socks/boot swabs or faeces (caged birds).

##### Meat producing flocks (broilers, turkeys, ducks, geese, guinea fowls)

*Before slaughter at farm*: Socks/boot swabs and dust swabs.

#### Methods of sampling (description of sampling techniques)

##### Breeding flocks

*Day-old chicks*: All flocks: Transport crates are tested (crate liners or swabs).

*Rearing period*: All flocks: Tested at 4 weeks of age and 2 weeks before moving by two pairs of socks.

*Production period*: All flocks: Tested every 2<sup>nd</sup> week by two pairs of socks (caged birds: faecal samples) and one dust sample.

##### Laying hens

*Day-old chicks*: All flocks: Transport crates are tested (crate liners or swabs).

*Rearing period*: All flocks: Tested two weeks before moving by 2 pair of socks (caged birds: faeces).

*Production period*: All flocks: Tested every 15 weeks by two pairs of socks (caged birds: faeces).

*Before slaughter*: All flocks for slaughter: Tested before slaughter by 2 pair of socks (caged birds: faeces).

#### Meat producing flocks (broilers, turkeys, ducks, geese, guinea fowls)

*Before slaughter at farm*: Every flock is sampled by one pair of socks and one dust sample.

#### Case definition

A positive flock is a flock from which *Salmonella* (irrespective of serovar) has been isolated from at least one sample.

#### Diagnostic/analytical methods used

Bacteriological method: ISO 6579:2002/Amd. 1:2007 (E) Amendment 1 Annex D.

#### Vaccination policy

Vaccination against *Salmonella* is prohibited in Norway.

#### Control program/mechanisms/notification system in place

The Norwegian *Salmonella* Control Programme is mandatory. Detection of *Salmonella*, irrespective of serovar, has been notifiable since 1965.

#### Measures in case of the positive findings or single cases

Whenever *Salmonella* is detected, the competent authorities must be notified without delay. Also, relevant food business operators, such as slaughterhouses, hatcheries, and egg collecting centres receiving animals or animal products from an infected animal holding must be informed. Stringent restrictions including cleaning and disinfection, control of animal movement and control of person admission will be imposed on an infected animal holding. Infected animals must be isolated from other animals. Whenever *Salmonella* is detected, epidemiological investigations also including the feed suppliers will be initiated in order to identify and eliminate the source of infection. If *Salmonella* is detected, the whole flock will be destroyed or subjected to sanitation slaughter. Eggs from hatcheries where *Salmonella* has been detected will be destroyed or pasteurized. If *Salmonella* is detected in chicks, all chicks from the same hatchery machine must be destroyed. Farms that have received infected chicks will be considered infected and restrictions will be imposed on these farms as well. Restrictions will be lifted when infected rooms have been cleaned and disinfected, bacteriological testing following cleaning and disinfection gives a negative test result, and the rooms have been empty for at least 30 days.

#### Results of the investigation

##### *Gallus gallus* breeding flocks

In 2011, a total of 103 rearing flocks and 163 production flocks were tested, all were negative.

##### *Gallus gallus* laying hen flocks

In 2011, a total of 140 rearing and 828 adult flocks were tested, one adult was positive (*S. diarizonae* 61:k:1,5,7).

##### *Gallus gallus* broiler flocks

In 2011, 4675 broiler flocks were investigated, and two were positive (*S. Typhimurium* and *S. enterica* subsp. *enterica* 4,12:i:-, respectively).

##### Other poultry (turkeys, ducks, geese)

In 2011, one breeder flock of geese (*S. Typhimurium*) and one turkey production flock (*S. Rissen*) were positive.

In addition to the Control Programme, samples have been taken in relation to clinical problems, follow up or various projects. For details, see table.

#### National evaluation of the recent situation, the trends and sources of infection

The favourable *Salmonella* situation in Norwegian poultry is partly dependent upon an efficient control of breeding flocks. Due to extensive surveillance during many years, stringent measures in case of positive findings, and restricted import, poultry breeding flocks in Norway are virtually free from *Salmonella*. *S. Agona* was found in a broiler parent flock in 2001. *S. Enteritidis* was for the first time detected in Norwegian poultry production in a broiler flock in 2007. *S. Enteritidis* has never been detected in Norwegian breeding flocks or in laying hens. The duck, geese, turkey and guinea fowl

populations in Norway are small. Since 2000, positive commercial flocks have been found sporadically; in 2000, two turkey flocks were positive for *S. Aberdeen* and *S. Typhimurium*, respectively and in 2011 one geese breeder flock (*S. Typhimurium*) and one turkey production flock (*S. Rissen*) were positive.

#### Relevance of the findings in animals to findings in foodstuffs and to human cases

The Norwegian Salmonella Control Programmes have documented that so far poultry in Norway as well as domestically produced poultry products are virtually free from *Salmonella*. Each year, approximately 75-80% of reported cases of salmonellosis in humans have acquired the infection abroad. This illustrates that domestic food products of animal origin represent a small risk to the consumer in regard to *Salmonella*, an assumption that is supported by case-control studies.

Table *Salmonella* in poultry and other birds

	Source of information	Sampling unit	Total units tested (official and industry sampling)	Total units positive for <i>Salmonella</i> spp.
<b>Gallus gallus (fowl)</b>				
Grandparents - egg line – production period	NSCP <sup>1</sup>	flock	4	0
Parents - egg line – rearing period	NSCP	flock	16	0
Parents - egg line – production period	NSCP	flock	19	0
Grandparents - meat line – production period	NSCP	flock	1	0
Parents - meat line – rearing period	NSCP	flock	87	0
Parents - meat line – production period	NSCP	flock	139	0
Laying hens – rearing period	NSCP	flock	140	0
Laying hens – production period <sup>2</sup>	NSCP	flock	828	1
Broilers <sup>3</sup>	NSCP	batch	4675	2
Unspecified	NVI	holding	31	0
<b>Ducks</b>				
Breeding flocks	NSCP	flock	4	0
Meat production flocks	NSCP	flock	67	0
Unspecified	NVI	holding	2	0
<b>Geese</b>				
Breeding flocks <sup>4</sup>	NSCP	flock	1	1
Meat production flocks	NSCP	flock	3	0
Unspecified	NVI	holding	1	0
<b>Turkeys</b>				
Breeding flocks	NSCP	flock	17	0
Meat production flocks <sup>5</sup>	NSCP	flock	208	1
Unspecified <sup>5</sup>	NVI	holding	8	1
<b>Other domestic birds (mainly pet psittacine birds)<sup>6</sup></b>	NVI	animal	20	1
<b>Birds in zoological gardens<sup>7</sup></b>	NVI	animal	16	4
<b>Wild birds<sup>8</sup></b>	NVI	animal	53	6

<sup>1</sup> NSCP = Norwegian *Salmonella* Control Programme

<sup>2</sup> One positive flock with *S. diarizonae* 61:k:1,5,7

<sup>3</sup> One positive flock with *S. Typhimurium*, one flock with *S. enterica* subsp. *enterica* 4,12:i-

<sup>4</sup> One parent geese flock had *S. Typhimurium*.

<sup>5</sup> One turkey flock had *S. Rissen*, both in the surveillance programme and in follow up samples.

<sup>6</sup> One pet pidgeon with *S. Typhimurium*.

<sup>7</sup> The positive birds came from one zoo and all had *S. Braenderup*.

<sup>8</sup> The positive birds all had *S. Typhimurium*.

Footnote: The samples reported from NVI (Norwegian Veterinary Institute) are mainly from clinical investigations, but might also represent import controls and other reasons for sampling.

## B. *Salmonella* spp. in pigs and cattle

### Monitoring system

*Pig breeding herds*: The Norwegian *Salmonella* Control Programme: All elite breeding herds are tested.

*Pig multiplying herds*: The Norwegian *Salmonella* Control Programme: Each year, a number of lymph node samples and carcass swabs are collected randomly from the sow population at slaughterhouse according to the slaughter volume. The sampling of lymph nodes is described in this chapter, the sampling of carcass swabs is described in the chapter on *Salmonella* in foodstuffs.

*Cattle and pig fattening herds*: The Norwegian *Salmonella* Control Programme: Each year, a number of lymph node samples and carcass swabs are collected by slaughter and proportionally distributed according to the slaughterhouses' capacities. The sampling of lymph nodes is described in this chapter, while the sampling of carcass swabs is described in the chapter on *Salmonella* in foodstuffs.

*Other strategies*: Animals are tested in relation to clinical surveillance and import.

### Frequency of the sampling

*Pig breeding herds*: Once a year.

*Animals at slaughter (herd based approach)*: Detection of an animal prevalence level of 0.1% by 95% confidence.

### Type of specimen taken

*Pig breeding herds*: Faeces.

*Animals at slaughter (herd based approach)*: Lymph nodes.

### Methods of sampling (description of sampling techniques)

*Animals at farm*: If there are clinical problems with diarrhoea, faecal samples will be taken.

*Pig breeding herds*: Faecal samples.

*Animals at slaughter (herd based approach)*: From each carcass at least five ileocaecal lymph nodes are aseptically removed and pooled in a plastic bag. All samples are kept refrigerated during the period of sampling and sent to the laboratory the same day.

### Case definition

A positive sample is a sample from which *Salmonella* has been isolated.

### Diagnostic/analytical methods used

Faeces: Annex D of ISO 6579/Amd. 1:2007 (E) Amendment 1 Annex D.

Lymph nodes: NMKL No 71:1999.

### Vaccination policy

Vaccination against *Salmonella* is prohibited in Norway.

### Control program/mechanisms/notification system in place

The Norwegian *Salmonella* Control Programme is mandatory. Detection of *Salmonella*, irrespective of serovar, has been notifiable since 1965.

### Measures in case of the positive findings or single cases

Whenever *Salmonella* is detected, the competent authorities must be notified without delay. Actions will be taken to identify and eliminate the source of the contamination in order to prevent further spread. Also, slaughterhouses and food production facilities receiving animals or animal products from an infected animal holding must be informed. Stringent restrictions including cleaning and disinfection, control of animal movement and control of person admission will be imposed on an infected animal holding. Infected animals must be isolated from other animals. Animals are not allowed to be sent to slaughter without permission from the Food Safety Authority and if sent to slaughter, the slaughterhouse must be notified so that sanitation slaughtering can be conducted. Milk from infected cattle herds must be pasteurised. Whenever *Salmonella* is detected, epidemiological investigations also including the feed suppliers will be initiated in order to identify and eliminate the source of infection. There will be intensified sampling, also on farms that have had contact with the infected holding. Restrictions will be lifted when all animals have been tested with a negative test result in two consecutive samplings with a minimum interval of 30 days. Following lifting of the restrictions, retesting will be conducted after approx. six months.

## Results of the investigation

### Pigs

In 2011, lymph node samples from a total of 2305 animals were tested in the Norwegian Salmonella Control Programme. One sample was positive (*S. Typhimurium*). None of the 98 herds tested with faecal samples (1767 samples in total) were positive.

In addition, more than 1300 samples from 150 different herds were investigated due to clinical problems, various controls and follow up of positive findings. Four herds were positive (*S. Bredeney* (2), *S. Bovismorbificans* (1) and *S. Typhimurium* (1)). The herd positive for *S. Bovismorbificans* was in the same holding as the cattle herd found positive for *S. Bovismorbificans*. A herd positive for *S. Typhimurium* also had positive cattle, three positive farmed foxes, one positive dog and a positive wild hedgehog. The *S. Typhimurium* isolate had a “hedgehog MLVA profile”. The two herds with *S. Bredeney* had contact with each other.

### Cattle

In 2011, a total of 2246 animals were sampled (lymph node samples) in the Norwegian Salmonella Control Programme. Ten samples (from seven different herds) were positive (*S. Typhimurium* (5 herds), *S. Hadar* and *S. Typhimurium* (1 herd), *S. enterica* subsp. *enterica* 4,5,12:i:- (1 herd)).

In addition, more than 2500 samples from 211 herds were investigated due to clinical problems, various controls and follow up of positive findings. Seven herds were positive (*S. Typhimurium* (4), *S. enterica* subsp. *enterica* 4,[5],12:i:- (2) and *S. Bovismorbificans* (1)). Two of the seven positive herds also had positive samples in the surveillance programme. The herd positive for *S. Bovismorbificans* was in the same holding as the pig herd found positive for *S. Bovismorbificans*. A herd positive for *S. Typhimurium* also had positive pigs, three positive farmed foxes, one positive dog and a positive wild hedgehog. The *S. Typhimurium* isolate had a “hedgehog MLVA profile”.

## National evaluation of the recent situation, the trends and sources of infection

The Norwegian *Salmonella* Control Programmes document that Norwegian food producing animals are virtually free from *Salmonella*. The surveillance data indicate that the overall prevalence is below 0.1%.

## C. *Salmonella* spp. in other animals

### Monitoring system

Described here is *Salmonella* in sheep and goats and other animal species than food producing animals, such as pets, zoo animals, reptiles and wild life. Sampling is done in relation to clinical surveillance and import.

### Case definition

A positive animal is an animal from which *Salmonella*, irrespective of serovar, has been isolated.

### Vaccination policy

Vaccination against *Salmonella* is prohibited in Norway.

### Measures in case of the positive findings or single cases

Whenever *Salmonella* is detected, the competent authorities must be notified without delay. Unless the finding is in a wild animal, epidemiological investigations will be initiated in order to identify and eliminate the source of infection.

### Notification system in place

Detection of *Salmonella*, irrespective of serovar, has been notifiable since 1965.

## Results of the investigation

For details see table.

### Relevance of the findings in animals to findings in foodstuffs and to human cases

A substantial proportion of the *S. Typhimurium* infections in humans are indigenous. This serovar, although not established among food animals in Norway, does occur in Norwegian wild birds and hedgehogs, and these two sources have been described to be the source for almost half of all indigenous *S. Typhimurium* cases. These two sources probably also constitutes a risk for food producing animals. Also, reptiles kept as pets pose a risk for transmission to humans.



Table *Salmonella* in animals other than birds

	Source of information	Sampling unit	Units tested	Total units positive for <i>Salmonella</i> spp.	<i>S. Typhimurium</i>	<i>S. enterica</i> subsp. <i>enterica</i> 4, [5], 12: i:-	<i>S. Bredeney</i>	<i>S. Bovismorbificans</i>	<i>S. diarizonae</i> (61: k:1,5,(7))	<i>Salmonella</i> spp.
<b>Cattle</b>										
Slaughtered animals - lymph nodes	NSCP <sup>1</sup>	animal	2246	10 <sup>2</sup>	8	1				1
Other investigations	NVI	herd <sup>3</sup>	211	7	4	2		1		
<b>Sheep</b>	NVI	herd	43	13					13	
<b>Pigs</b>										
Breeding animals – at farm	NSCP	herd	98	0						
Slaughtered animals – lymph nodes	NSCP	animal	2305	1	1					
Other investigations	NVI	herd <sup>3</sup>	150	4	1		2	1		
<b>Horses</b> <sup>4</sup>	NVI	animal	160	36		36				
<b>Alpacas and llamas</b>	NVI	herd	11 <sup>5</sup>	1	1					
<b>Deer (farmed)</b>	NVI	animal	3	2	2					
<b>Cats</b>	NVI	animal	138	5	5					
<b>Dogs</b> <sup>6</sup>	NVI	animal	469	19	5	3				11
<b>Pets (rabbit, chinchilla etc.)</b>	NVI	animal	16	0						
<b>Turtles</b> <sup>7</sup>	NVI	animal	4	1						1
<b>Fur animals</b>	NVI	herd	5	1	1					
<b>Wild animals</b>	NVI	animal	10	3	3					
<b>Zoo animals</b> <sup>8</sup>	NVI	animal	40	27						27

<sup>1</sup> NSCP = Norwegian *Salmonella* Control Programme.

<sup>2</sup> Ten animals from seven herds. One herd had a double infection with *S. Hadar* (in column *Salmonella* spp.) and *S. Typhimurium*.

<sup>3</sup> One herd had both cattle and pigs positive for *S. Bovismorbificans*. Another herd had both cattle and pigs positive for *S. Typhimurium*. This herd also had a positive dog, three farmed foxes and a wild hedgehog.

<sup>4</sup> The 36 positive animals belonged to five different owners.

<sup>5</sup> A total of 91 alpacas and 26 llamas.

<sup>6</sup> The 11 dogs reported in column *Salmonella* spp. were positive for: *S. Kedougou* (6), *S. Virchow* (2), *S. Livingstone* (1), *S. Goldcoast* (1) and *S. Derby* (1).

<sup>7</sup> Excluding turtles from zoos. The positive animal reported in column *Salmonella* spp. was positive for: *S. salamae* 47:a:1,5.

<sup>8</sup> Animals from five zoos and similar holdings. The 27 positive animals were mainly snakes and reptiles and a total of 27 different serovars were isolated from these animals.

Footnote: The samples reported from NVI (Norwegian Veterinary Institute) include clinical investigations, follow up of positive findings, import controls and other reasons for sampling. Animal species where the number of samples were <10 and all samples were negative are not reported.

## Salmonella in feedingstuffs

### History of the disease and/or infection in the country

Norway has for many years performed an extensive surveillance of feedingstuffs and imposed stringent measures in case of positive findings. The import of animal compound feedingstuffs has also been restricted for many years. The result is that the feedingstuffs given to Norwegian livestock for many years have virtually been free from *Salmonella*.

### National evaluation of the recent situation, the trends and sources of infection

Extensive surveillance systems for *Salmonella* in regard to feedingstuffs are established in order to prevent animals from being exposed to contaminated feed. Feedingstuffs for both terrestrial animals and fish are covered by surveillance programmes. The surveillance programmes document a low prevalence of *Salmonella* in domestically produced animal compound feedingstuffs. However, data from process control, including environmental sampling, indicates that there are certain serovars that sometimes contaminate production facilities, especially those producing fish feed.

### Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases

The favourable *Salmonella* situation in animals and humans in Norway is partly dependent upon the efficient control of animal feedingstuffs. The number of animals infected through feedingstuffs is probably very low, and this route of infection probably represents a negligible risk to humans.

### Recent actions taken to control the zoonoses

According to the regulation, establishments are required to prevent the introduction of *Salmonella* and carry out monitoring. Detection of *Salmonella* is notifiable and the establishment must take immediate actions to prevent the distribution of contaminated feed. Contaminated feed will either be destroyed or decontaminated if feasible.

Establishments producing feedingstuffs and protein concentrates (supplementary feedingstuffs) intended for poultry, pigs, and cattle are exposed to heat treatment of at least 81 degrees Celsius core temperature and the production has to take place in a production line where all the other feedingstuffs are heat treated. As for *Salmonella* the monitoring of the acceptability of the process includes sampling of minimum three samples every fortnight (all poultry feed mills and pig and cattle feed mills with a capacity above 10,000 tons per year) or every fourth week (pig and cattle feed mills with a capacity below 10,000 tons per year). The sampling includes samples of raw materials, scrapings from control points and environment.

Establishments producing fish feed are required to establish individual designed *Salmonella* control programmes based on HACCP.

Establishments preparing feed for fur animals are required to test each batch for the presence of *Salmonella*. The national production of meat and bone meal is subject to a continuous process control that includes analyses for *Salmonella*.

Official control is based on random sampling at the establishments.

Imported feed materials must be subjected to control for *Salmonella* before distribution or use. The number of samples depends on the amount and whether the feedingstuffs are classified as high-risk (such as soy beans, cotton seed and maize) or low-risk materials. Imported feed of animal origin, predominantly petfood and dogchews, must be accompanied with a certificate that documents that the lot has been controlled for *Salmonella*.

In addition to the surveillance run by the government or the industry itself, feedingstuffs are also subjected to analyses for *Salmonella* in relation to epidemiological investigations and specific surveys and studies.

Table *Salmonella* in feedingstuffs

	Source of information	Total units <sup>1</sup> tested	Units tested in official controls	Units tested in surveillance by industry	Total units positive for <i>Salmonella</i> spp. <sup>2</sup>
<b>Feed matter</b>					
Barley derived	NFSA	95	0	95	0
Oat derived	NFSA	24	0	24	0
Wheat derived	NFSA	205	0	205	0
Maize (including maize derived)	NFSA	329	0	329	2
Rape seed derived	NFSA	289	0	289	1
Soya(bean) derived	NFSA	3292	0	3292	60
Sunflower seed derived	NFSA	58	0	58	0
Legume seeds and similar products	NFSA	45	0	45	0
Groundnut derived	NFSA	18	0	18	0
Meat and bone meal and animal fat	NFSA	286	0	286	4
Fish meal and other fish products	NFSA	161	0	161	1
<b>Compound feedingstuffs for</b>					
cattle, swine, poultry	NFSA	53	0	53	0
fish	NFSA/NIFES	865	25	840	30
fur animals	NFSA	405	0	405	0
.. pets	NFSA	14	14	0	0
<b>Environmental samples</b> including process control samples – not specified to production	NFSA	13344	194	13150	129

<sup>1</sup> Units = partly batches and partly single samples.

<sup>2</sup> The positive samples were mainly imported feed material or environmental samples.

## Antimicrobial resistance in *Salmonella* isolates

### Sampling strategy used in monitoring

All *Salmonella* found in production animals, irrespective if they are found in the Norwegian *Salmonella* Control Programmes or in connection with clinical problems, surveys or other investigations, are included in the resistance monitoring (only one isolate per herd). *Salmonella* isolated from other animals may be susceptibility tested as well. Exceptions from the rules described above are that not all *S. diarizonae* from sheep or *S. Typhimurium* from wild birds and wild animals or *Salmonella* from reptiles, wild animals or zoo animals are tested every year.

### Type of specimen taken

*Salmonella* isolates collected through the Norwegian *Salmonella* Control programmes, which include those animal species required by the Commission Decision No 2007/407/EC on the harmonised monitoring of antimicrobial resistance in *Salmonella*. Isolates from other samples vary depending on the situation.

### Methods of sampling (description of sampling techniques)

For description of the Norwegian *Salmonella* Control programmes, see the parts describing *Salmonella* in the various animal species. Other sampling methods vary depending on the situation.

### Procedures for selection of isolates for antimicrobial testing and methods used for collecting data

One isolate per herd is selected for antimicrobial testing. *Salmonella* is isolated at various laboratories and sent to the Norwegian Veterinary Institute in Oslo for testing of antimicrobial susceptibility.

### Laboratory methodology used for identification of the microbial isolates

Normally, ISO 6579:2002 or NMKL No 71:1999 are used for isolation of *Salmonella*. However, isolates may have been obtained by other methods as well.

### Laboratory methods used for detection for resistance

The VetMIC microdilution method (Dept. of Antibiotics, National Veterinary Institute, Sweden) is used for the susceptibility testing of all isolates. The antimicrobials included are listed in the tables.

### Cut-off values used in testing

For interpretation of results epidemiological cut-off values recommended by EFSA were applied.

### Control program/mechanisms

The resistance testing of *Salmonella* isolated from animals is a part of the Norwegian monitoring programme for antimicrobial resistance in feed, food and animals - NORM-VET.

### Results

The qualitative data are presented in the table. Quantitative data as well as data on breakpoints and range of testing are presented in the NORM/NORM-VET 2011 report.

Table Antimicrobial susceptibility testing of *Salmonella* spp.

	<i>Salmonella</i> spp.
<b>Number of isolates tested</b>	49
<b>Number of isolates resistant to</b>	
Tetracycline	15
Chloramphenicol	2
Cefotaxime	0
Ciprofloxacin	2
Nalidixic acid	2
Sulfamethoxazole	15
Trimethoprim	0
Streptomycin	16
Gentamicin	0
Ampicillin	15

# Campylobacteriosis

## *General evaluation of the national situation*

### History of the disease and/or infection in the country

Norwegian studies have shown that many species of wild birds, especially crows and seagulls, are frequent carriers of thermophilic *Campylobacter* spp. Thermophilic *Campylobacter* spp. have also been isolated from poultry, dogs, cats, pigs, sheep, cattle, and flies, and sporadically from wild mammals. Before 2001, when the surveillance programme in broilers was implemented, the prevalence of thermophilic *Campylobacter* spp. in Norwegian broiler flocks had been studied twice. In 1990, 18% of the flocks tested were infected, whereas this proportion in 1997-1998 had decreased to 4%. This reduction was attributed to an increased focus on the importance of biosecurity.

The Action Plan against *Campylobacter* in broilers that started in 2001 has shown that the yearly incidence of broiler flocks being positive for *Campylobacter* has varied between 3.3% and 6.3% in the years 2002-2007. The data from 2008 - 2011 are not directly comparable to previous years because the sampling was reduced in 2008 to sampling prior to slaughter only and in 2009 the surveillance was altered from full year surveillance to the period between 1<sup>st</sup> May to the end of October when the incidence is highest. The estimated full year prevalence of positive flocks in 2008 - 2011 has varied between 4.2% and 5.5%.

The number of flocks going positive out on the market has been reduced from 127 in 2002 to 58 in 2007. The estimated number of positive flocks out on the market in 2008 and 2011 has varied between 64 and 93.

In 1998, campylobacteriosis for the first time surpassed salmonellosis as the most frequently reported bacterial cause of acute human gastroenteritis in Norway, and since then the reported incidence of campylobacteriosis has been above that of salmonellosis. Since the beginning of the 1990s and until it peaked in 2001, there was a major increase in the incidence of campylobacteriosis in Norway, both in domestic and imported cases. Usually, 50-60% of the cases are imported.

### National evaluation of the recent situation, the trends and sources of infection

The reported human incidence in 2011 was slightly higher than the incidence reported in 2010. The data on prevalence in broiler flocks in 2011 were not as complete as the data from the period 2001 - 2007, but we assume that there is no major change in the prevalence. We also assume that in 2011, as in earlier years, the majority of the positive flocks were detected before slaughter, and were therefore treated (i.e. frozen or heat treated) before they went on the market. The use of untreated water is considered an important source of campylobacteriosis in Norway.

### Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases

The poultry production and poultry consumption has increased during the last years. Even if the Norwegian action plan against *Campylobacter* in broilers have largely reduced the number of *Campylobacter* positive broiler carcasses entering the market, there are still positive broiler carcasses on the market. In addition, other food products may also be positive for *Campylobacter*. An important source of human campylobacteriosis in Norway is the use of untreated water, in private homes and cottages and during camping and hiking.

### Recent actions taken to control the zoonoses

The implementation of the Norwegian action plan against *Campylobacter* in broilers in 2001 was a direct response from the authorities, scientific institutions and the industry to the major increase in human campylobacteriosis that was seen during the late 1990s and up to 2001.

## *Campylobacteriosis in humans*

### Reporting system in place for the human cases

Human cases are reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), from microbiological laboratories as well as from clinical doctors. The system distinguishes between domestic and imported cases. The severity of the disease at the time of reporting is also recorded. However, the surveillance system does not follow individual patients over time to record further disease development and final outcome.

### Case definition

A case from which *Campylobacter* spp. has been isolated or a clinical compatible case with an epidemiological link to a culture confirmed case.

### Diagnostic/analytical methods used

Bacteriology (isolation of *Campylobacter* species from faecal samples) followed by voluntary confirmation (species identification and biotyping) at the National Reference Laboratory. Due to the methods applied, *C. lari* and *C. upsaliensis* are probably underdiagnosed.

### Notification system in place

According to the Communicable Disease Act, human cases are notifiable to the Norwegian Surveillance System for Communicable Diseases (MSIS) since 1991.

### History of the disease and/or infection in the country

Since the beginning of the 1990s and until it peaked in 2001, there was a significant increase in the incidence of campylobacteriosis in Norway. In 1998, campylobacteriosis for the first time surpassed salmonellosis as the most frequently reported bacterial cause of acute gastroenteritis, and since then the reported incidence of campylobacteriosis has been above that of salmonellosis. Usually, 50-60% of the cases are imported. Most cases are sporadic. A case control study conducted in Norway during 1999-2000 identified consumption of untreated drinking water, consumption of poultry meat purchased fresh, consumption of barbecued meat, and professional contact with animals as significant risk factors in regard to campylobacteriosis. Daily contact with dogs/cats was identified as a risk factor in case control studies conducted during the early 1990s, but was not identified as a risk factor in the 1999-2000 study. Studies indicate that the vast majority (~95%) of reported cases are due to *C. jejuni*, and that *C. coli* is the cause of most of the remaining cases.

### Results of the investigation

In 2011, a total of 3005 cases (incidence rate 61,1 per 100 000) were reported of which 1475 (49%) were known to be imported, 1165 (39%) were domestic and 365 (12%) had an unknown place of infection. One waterborne outbreak of campylobacteriosis was registered, additionally four smaller outbreaks were reported; one suspected waterborne and three associated with restaurant visits. No deaths due to campylobacteriosis were reported.

### National evaluation of the recent situation, the trends and sources of infection

The number of reported domestic cases increased in 2011 compared to 2010. The incidence of domestic human campylobacteriosis has been relatively stable around 1100 cases annually during the last five years. As the overall occurrence of positive broiler flocks is low, there must be other important sources to human campylobacteriosis apart from poultry products in Norway, untreated drinking water probably being the most important one.

### Relevance as zoonotic disease

*Campylobacter* is the most frequently reported cause of bacterial gastroenteritis in Norway. Every year, approximately half of the reported cases have acquired the infection in Norway.

### Additional information

Patients whose work represents a risk for spread of the disease, e.g., in food production and health care, are advised to stay away from such work while they are having symptoms. It is recommended that for these patients two consecutive faecal samples examined after the symptoms have disappeared should be negative before returning to work.

Table Campylobacteriosis cases infected in Norway 2006 - 2011. Incidence rate (IR) per 100.000 inhabitants 2011.

County	2006	2007	2008	2009	2010	2011	IR 2011
Østfold	31	37	62	52	34	63	22.9
Akershus	90	92	99	88	89	91	16.7
Oslo	80	93	86	129	108	113	18.9
Hedmark	42	31	43	53	38	38	19.8
Oppland	57	39	62	45	31	68	36.5
Buskerud	58	47	47	65	42	48	18.4
Vestfold	43	36	69	47	57	42	18.0
Telemark	32	36	33	41	25	37	21.9
Aust-Agder	33	16	20	13	9	17	15.4
Vest-Agder	32	27	20	22	27	43	24.9
Rogaland	170	198	157	162	145	174	39.9
Hordaland	159	154	125	174	127	135	27.9
Sogn & Fjordane	28	26	20	44	24	45	41.8
Møre & Romsdal	50	53	39	64	55	54	21.3
Sør-Trøndelag	87	114	107	120	92	85	28.9
Nord-Trøndelag	20	39	36	40	39	27	20.4
Nordland	33	50	33	40	30	47	19.8
Troms	42	50	33	34	14	25	15.9
Finnmark	10	15	11	22	12	13	17.7
<b>Total</b>	<b>1097</b>	<b>1153</b>	<b>1102</b>	<b>1255</b>	<b>998</b>	<b>1165</b>	<b>23.7</b>

## Campylobacter in foodstuffs

Thermophilic *Campylobacter* in broiler meat and products thereof

### Monitoring system

See chapter on *Campylobacter* in *Gallus gallus*.

### Methods of sampling/definition of positive finding

See chapter on *Campylobacter* in *Gallus gallus*.

### Preventive measures in place

In the surveillance programme, the broiler flocks found positive before slaughter are subjected to freezing for at least 3 weeks or heat treatment.

### Control program/mechanisms

The Norwegian action plan against *Campylobacter* in broilers is a surveillance programme agreed upon by the Norwegian Food Safety Authority, scientific institutions and the poultry industry.

### Recent actions taken to control the zoonoses

The establishment of the Norwegian action plan against *Campylobacter* in broilers was a direct response to the major increase in the incidence of human campylobacteriosis during the 1990s.

### Measures in case of the positive findings or single cases

See chapter on *Campylobacter* in *Gallus gallus*.

### Notification system in place

All findings in the Norwegian action plan against *Campylobacter* in broilers are reported and published as summary reports.

### Results of the investigation

The results from the Norwegian action plan against *Campylobacter* in broilers are presented in the chapter on *Campylobacter* in *Gallus gallus*.

### National evaluation of the recent situation, the trends and sources of infection

The Norwegian campylobacteriosis situation is a concern for the authorities. The establishment of the Norwegian action plan against *Campylobacter* sp. in broilers in 2001 was a response to the urgent situation. This action plan has since it was established and through 2011 prevented millions of *Campylobacter* positive broiler carcasses from entering the market raw.



## Campylobacter in animals

### Thermophilic *Campylobacter* in *Gallus gallus*

#### Monitoring system

A surveillance programme in broilers was implemented in May 2001 (part of the Norwegian action plan against *Campylobacter* in broilers).

#### Frequency of the sampling

*Before slaughter at farm:* Between 1 May and 31 October, which corresponds with the high season for *Campylobacter* positive flocks, every flock is sampled.

*At slaughter:* Flocks where the result from the pre slaughter sample is lacking at the time of slaughter are sampled by staff from the Norwegian Food Safety Authority.

#### Type of specimen taken

*Before slaughter at farm:* Faeces

*At slaughter:* Caecum

#### Methods of sampling (description of sampling techniques)

*Before slaughter at farm:* 10 swabs from fresh faecal droppings are taken by the owner maximum four days before slaughter. They are transported dry as one pooled sample to the laboratory.

*At slaughter:* 10 caecae are sampled at the slaughter line. The 10 samples are pooled to one at the laboratory.

#### Case definition

*Before slaughter at farm:* A flock where *Campylobacter* spp. is found.

*At slaughter:* A slaughter batch where *Campylobacter* spp. is found.

#### Diagnostic/analytical methods used

*Before slaughter at farm:* PCR Real Time PCR

*At slaughter:* ISO 10272-1:2006.

#### Vaccination policy

There is no vaccination against *Campylobacter* in Norway.

#### Other preventive measures than vaccination in place

Farms producing *Campylobacter* positive flocks are subject to follow-up visits from the advisors in the industry and veterinary supervisors from the Norwegian Food Safety Authority to assist in implementing measures preventing further flocks to be infected with *Campylobacter*.

#### Control program/mechanisms

The Norwegian action plan against *Campylobacter* in broilers is a surveillance programme agreed upon by the Norwegian Food Safety Authority, scientific institutions and the poultry industry. The surveillance programme is compulsory.

#### Recent actions taken to control the zoonoses

The establishment of the Norwegian action plan against *Campylobacter* in broilers was a direct response to the major increase in the incidence of human campylobacteriosis during the 1990s.

#### Measures in case of the positive findings or single cases

Carcasses from flocks that are positive for thermophilic *Campylobacter* sp. based upon the pre-slaughter sampling are either subjected to heat-treatment or frozen for a minimum of three weeks. The poultry industry uses data from the surveillance programme as an incentive for improving the hygienic conditions on broiler farms.

#### Notification system in place

All positive flocks in the surveillance programme are reported to the authorities.

#### Results of the investigation

In 2011, in the period 1 May - 31 October, a total of 2280 samples (representing approx the same number of flocks, and covering virtually all slaughtered flocks in Norway in that period) were taken approximately four days before slaughter. In addition, two samples were taken at slaughter due to lack of results from the pre-slaughter sample. A total of 139 samples (6.1%) were positive for *Campylobacter* spp.

## National evaluation of the recent situation, the trends and sources of infection

The poultry production has increased in Norway during the last years. The yearly prevalence of flocks being positive for *Campylobacter* from 2002 to 2007 was between 3.3 and 6.3%. The results from 2008 - 2011 are not directly comparable to previous years, but the annual prevalence has been estimated to vary between 4.2% and 5.5%.

## Relevance of the findings in animals to findings in foodstuffs and to human cases

The overall occurrence of positive broiler flocks is low, but there is a large seasonal variation with a peak during the summer and autumn, and the surveillance programme is therefore covering that period of the year. Even though approximately 75% of the positive flocks are discovered before slaughter, and thereby subject to compulsory freezing or heat treatment, the number of *Campylobacter* positive broiler carcasses on the market during the summer can be considerable.

Table *Campylobacter* in animals

	Source of information	Sampling unit	Units tested	Total units positive for <i>Campylobacter</i> spp.	<i>C. jejuni</i>	<i>C. coli</i>	<i>C. upsaliensis</i>	<i>C. spp.</i> , unspecified
<b><i>Gallus gallus</i> (fowl)</b>								
Broilers – at farm	NACB <sup>1</sup>	flock	2282	139				139
<b>Cattle</b>	NVI <sup>2</sup>	animal	230	70	40			30
<b>Sheep</b>	NVI <sup>2</sup>	animal	49	5	4			1
<b>Goats</b>	NVI <sup>2</sup>	animal	7	1				1
<b>Horses</b>	NVI <sup>2</sup>	animal	13	0				
<b>Dogs</b>	NVI <sup>2</sup>	animal	407	103	12		79	12
<b>Cats</b>	NVI <sup>2</sup>	animal	107	3	1		1	1

<sup>1</sup> NACB = Norwegian Action plan against *Campylobacter* in Broilers. Only covering the peak season 1 May - 31 October. Samples are taken by owner 4 days before slaughter. There is no data available on the *Campylobacter* species because the method used is a Real time PCR method where no isolates are obtained.

<sup>2</sup> NVI = Norwegian Veterinary Institute: Diagnostic samples.

## Antimicrobial resistance in *Campylobacter* isolates

### Antimicrobial resistance in *Campylobacter* sp. from cattle

#### Sampling strategy used in monitoring

As part of the Norwegian action plan against *Campylobacter* in broilers (see chapter on Thermophilic *Campylobacter* in *Gallus gallus*), caecal samples were collected at slaughter plants. One isolate per positive flock was to be included for susceptibility testing.

#### Type of specimen taken

See Thermophilic *Campylobacter* in *Gallus gallus*.

#### Methods of sampling (description of sampling techniques)

See Thermophilic *Campylobacter* in *Gallus gallus*.

#### Procedures for the selection of isolates for antimicrobial testing

One isolate of *Campylobacter jejuni* from each positive flock was selected for antimicrobial testing.

#### Methods used for collecting data

Strains were isolated and tested for the antimicrobial susceptibility at the Norwegian Veterinary Institute in Oslo.

#### Laboratory methodology used for identification of the microbial isolates

NMKL No 119 without enrichment.

#### Laboratory methods used for detection for resistance

The VetMIC microdilution method (Dept. of Antibiotics, National Veterinary Institute, Sweden) was used for the susceptibility testing of all isolates. The antimicrobials included are listed in the table.

#### Cut-off values used in testing

Epidemiological cut-off values recommended by EFSA were used.

#### Control program/mechanisms

The resistance testing of *Campylobacter jejuni* isolated from broiler flocks is a part of the Norwegian monitoring programme for antimicrobial resistance in feed, food and animals NORM-VET.

#### Results

The qualitative data are presented in the table. Quantitative data as well as data on breakpoints and range of testing are presented in the NORM/NORM-VET 2011 report.

Table Antimicrobial susceptibility testing of *Campylobacter jejuni*

	Broiler
<b>Number of isolates tested</b>	48
<b>Number of isolates resistant to</b>	
Tetracycline	1
Ciprofloxacin	2
Streptomycin	1
Gentamicin	0
Erythromycin	0
Nalidixic acid	3

# Listeriosis

## *General evaluation of the national situation*

### History of the disease and/or infection in the country

Listeriosis is endemic in Norway with sporadic clinical cases in humans and animals, especially among sheep. Since 1982, the number of notified human cases has varied from 2-50. The incidence rate has varied from 0.05-1.07 per 100 000. Most of the cases are sporadic, occurring in old people or persons with an underlying disease. A few congenital cases have been reported.

An outbreak occurred in 1992 which involved six reported cases and was traced back to contaminated, vacuum packed cold cuts from a Norwegian meat producer. In 2005 a hospital outbreak occurred with three cases, probably linked to cold cuts (the same strain of *L. monocytogenes* as isolated from the patients was found on the slicing machine in the hospital kitchen). In 2007 another outbreak with 21 verified cases occurred and was caused by contaminated soft cheese.

In a survey conducted in 1994, the prevalence of *L. monocytogenes* in samples of vacuum packed cold cuts and smoked salmon was 1.7% and 7.8%, respectively. The prevalence in smoked salmon was 3.4% in a survey conducted in 1996-1997. In 2002 4.3% of 703 samples of domestically produced fish and fish products, mainly unprocessed and smoked salmon, were positive for *L. monocytogenes*. In 2003, 8.6% of 990 samples of smoked salmon taken at retail level were positive for *L. monocytogenes*. The level of contamination was less than 10 CFU/g in 53 samples, between 10 and 100 in 20 samples, between 100 and 1000 in 10 samples and more than 1000 CFU/g in two samples. In a survey conducted in 1995 involving ready-to-eat poultry products, the prevalence of *L. monocytogenes* was 0.4%. A survey of domestically produced raw milk products conducted in 1999 revealed that one out of 282 samples (0.4%) was positive for *L. monocytogenes*. A survey of raw bulk milk at Norwegian dairy farms, also conducted in 1999, did not detect any *L. monocytogenes* in 336 samples from cattle bulk milk, whereas four of 100 samples from goat bulk milk were positive for *L. monocytogenes*. This illustrates that products made of raw milk might be risk products with regard to *L. monocytogenes*.

Fermented trout is a traditional food product in Norway that is consumed without heat treatment. Studies have shown that fermented trout frequently is contaminated with *L. monocytogenes*, sometimes in high concentrations (up to 2000 CFU per gram). Former guidelines issued by the Food Safety Authority recommended a maximum level of 1000 CFU per gram for this particular product combined with information about risk products to vulnerable consumers. Recent studies have shown that it is possible to produce fermented trout without *L. monocytogenes* if hygienic precautionary measures, including temperature control and appropriate salt levels, are implemented throughout the process.

### National evaluation of the recent situation, the trends and sources of infection

Listeriosis is endemic in Norway with sporadic clinical cases in animals, especially among sheep. However, listeriosis is not a common disease in humans in Norway. Most cases are sporadic and seen in the elderly or in patients with underlying disease. Ready-to-eat products have been identified as a source for human listeriosis.

### Recent actions taken to control the zoonoses

The requirements of the Regulation (EC) No 2073/2005 apply, i.e., monitoring of the production process, shelf-life studies when deemed appropriate, withdrawal from the market when unsatisfactory results and taking measures to prevent the recurrence of the contamination, such as reviewing the production routines and shelf life of the product. Dietary advice is given to pregnant women.

## *Listeriosis in humans*

### Reporting system in place for the human cases

Human cases are reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), from microbiological laboratories as well as from clinical doctors. The system distinguishes between domestic and imported cases. The severity of the disease at the time of reporting is also recorded. However, the surveillance system does not follow individual patients over time to record further disease development and final outcome.

#### Case definition

A case from which *L. monocytogenes* has been detected in blood, cerebrospinal fluid or other normally sterile sites or a case with serology indicating recent infection.

#### Diagnostic/analytical methods used

Bacteriology (isolation of *L. monocytogenes* from a normally sterile site) followed by voluntary confirmation (species identification and serotyping) at the National Reference Laboratory.

#### Notification system in place

According to the Communicable Disease Act, human cases are notifiable to the Norwegian Surveillance System for Communicable Diseases (MSIS) since 1975.

#### History of the disease and/or infection in the country

Since 1982, the number of notified cases has varied from 2-50. The incidence rate has varied from 0.05-1.07 per 100 000. Most of the cases are sporadic, occurring in elderly individuals or persons with underlying disease. A few congenital cases are also being reported. The first recorded outbreak of listeriosis in Norway occurred in 1992, involving six reported cases. The outbreak was linked to vacuum packed cold cuts. In 2005, an outbreak occurred in a hospital in the middle of Norway. Three cases were reported, and the outbreak was linked to cold cuts. Another outbreak occurred in 2007, involving 21 reported cases of whom two died. The outbreak was linked to a Norwegian pasteurised soft cheese.

#### Results of the investigation

In 2011, a total of 21 confirmed cases of listeriosis were notified (incidence rate 0.4 per 100 000), 19 cases were infected in Norway, and two had an unknown place of infection. Four deaths were recorded.

#### National evaluation of the recent situation, the trends and sources of infection

Listeriosis in humans is a relatively rare disease in Norway and has been so for many years. Most of the cases are sporadic, occurring in elderly individuals or persons with underlying diseases. There is, however, an increasing trend if we look at the number of recorded cases over a twenty year period. The increase is not seen in pregnancy-associated cases. The reason for this increasing trend is unknown, but could be related both to an increase in the number of elderly individuals and persons with other underlying diseases, and to increased exposure to *L. monocytogenes* in consumed food.

#### Relevance as zoonotic disease

Listeriosis in humans is a relatively rare disease in Norway.

### *Listeria* in foodstuffs

#### Monitoring system

No continuous monitoring of foodstuffs takes place. Surveys are occasionally performed. Norway follows the EU requirements regarding testing for *L. monocytogenes* in ready-to-eat foods (Regulation (EC) NO 2073/2005). Samples are taken as part of internal control programmes in the food producing industry.

#### Definition of positive finding

A positive sample is a sample from which *Listeria* spp. has been isolated.

#### Diagnostic/analytical methods used

*At the production plant:* NMKL No 136:2007, ISO 11290-1:1996/Amd 2004, ISO 11290-2/Amd 2004, alternative methods including Rapid L'mono and molecular methods.

*At retail:* NMKL No 136:2007, ISO 11290-1:1996/Amd 2004, ISO 11290-2:1998 PSV, alternative methods including Rapid L'mono and molecular methods.

#### Control program/mechanisms

No official control programmes in place. When relevant, monitoring and control take place as an integral part of food business operators' internal control systems.

#### Measures in case of the positive findings

The requirements of the Regulation (EC) No 2073/2005 apply, i.e., monitoring of the production process, shelf-life studies when deemed appropriate, withdrawal from the market by unsatisfactory results and taking measures to prevent the recurrence of the contamination, such as reviewing the production routines and shelf life of the product.

### Results of the investigation

In 2011, a total of 93 samples of imported fishery products and 70 samples from Norwegian raw fish were investigated. Only one sample of imported origin was found positive.

### National evaluation of the recent situation, the trends and sources of infection

In general, the occurrence of *L. monocytogenes* in food products is low.

## Listeria in animals

### Monitoring system

Listeriosis is a notifiable disease in animals. There are no active surveillance regarding *L. monocytogenes* in animals. Information is achieved through clinical and laboratory reports.

### Frequency of the sampling

When there is a suspected case.

### Case definition

A case may be defined by 1) positive histopathology combined with clinical signs, 2) positive bacteriology.

### Diagnostic/analytical methods used

Bacteriology, histopathology and immunohistochemistry.

### Measures in case of the positive findings or single cases

Normally none.

### Notification system in place

Listeriosis has been a list C disease according to the Animal Disease Act since 1965.

### Results of the investigation

Many animals are investigated with regard to *L. monocytogenes* and listeriosis in clinical laboratories. In 2011, at the Norwegian Veterinary Institute, 30 sheep, 14 goats, two cattle, two llamas, three horses, one roe deer and one chinchilla were found positive.

### Relevance of the findings in animals to findings in foodstuffs and to human cases

*Listeria* spp. is present in the environment and also in food producing animals. However, there is no epidemiological evidence that listeriosis in humans are linked to listeriosis in animals.

## *E. coli* infections

### *General evaluation of the national situation*

#### History of the disease and/or infection in the country

The reported incidence of VTEC infections in humans in Norway has been increasing during the last years, but is still relatively low. The increase is probably partly, but not fully, explained by better diagnostics tools and increased awareness due to two severe outbreaks; In 2006 there was a severe outbreak caused by VTEC O103:H25 with 17 patients, out of which 10 developed HUS and one died. In 2009 there was another outbreak, caused by sorbitol fermenting *E. coli* O157:H-. There were 19 cases, out of which 9 developed HUS and one died. In 2010, a smaller outbreak occurred, with 3 cases infected with the same strain as in the 2009-outbreak. Approximately half of the total reported cases are acquired domestically.

A study conducted in 1995 revealed a low prevalence of VTEC O157 among Norwegian dairy cattle; animal prevalence 0.3% and herd prevalence 1.0%. In a survey conducted in 1998-1999, one out of 574 dairy cattle herds were positive for VTEC O157 (herd prevalence 0.2%, animal prevalence between 0.02 and 0.06%). In 2000, none of the tested 1435 beef cattle from 165 herds were positive for VTEC O157. A survey in 2002, in which 453 pooled faecal samples from 155 beef cattle herds were tested for the presence of VTEC O26, O103, O111, O145 and O157, revealed five pooled samples from five herds positive for VTEC O103, all *eae* negative.

In the surveillance programme for VTEC O157 in cattle, sheep, and goat carcasses running in the period 1998-2004, the total carcass prevalence was 0.06% for cattle and 0.03% for sheep. None of the 510 goat carcasses tested were positive.

In a national survey of *E. coli* in sheep conducted in 2006-2007, samples from 585 flocks were analysed, 94 flocks from 2006 and 491 flocks from 2007. VTEC O103:H2 (*stx*<sub>1</sub> and *eae* positives) were detected in 0.7% and VTEC O157:H7 (*stx*<sub>2</sub> and *eae* positives - one was also *stx*<sub>1</sub> positive) in 0.9% of the flocks. Only the 2007 samples were analysed for *E. coli* O26, and VTEC O26 were detected in 0.8% of the flocks. In addition *stx* negative and *eae* positive *E. coli* O26 were detected in 16.1%, *stx* negative and *eae* positive *E. coli* O103:H2 in 3.1%, and *stx* negative and *eae* positive *E. coli* O103:H25 in 5.8% of the flocks.

#### National evaluation of the recent situation, the trends and sources of infection

Although the annual incidence in humans in Norway up to 2006 was low and predominantly involved sporadic cases, the fear that the incidence might increase in the future, and that outbreaks may occur proved valid in 2006. Data show that VTEC O157 is present in the cattle and sheep populations, and although the prevalences seem to be low, this reservoir represents a source of possible human infection. The 2006 outbreak caused by VTEC O103:H25 showed that other VTEC than the "high five" (VTEC O26, O103:H2, O111, O145 and O157) may be of potential danger to humans.

#### Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases

Although the prevalence of VTEC O157 in the cattle and sheep populations seems to be low, there are other VTEC where the knowledge is sparse. In general, there is always a potential for contamination in the food chain, which requires alertness at all steps from primary production, through processing, and retail and food preparation, as well as alertness among physicians and diagnostic laboratories.

## *E. coli* infections in humans

#### Reporting system in place for the human cases

Human cases are reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), from microbiological laboratories as well as from clinical doctors. The system distinguishes between domestic and imported cases. The severity of the disease at the time of reporting is also recorded. However, the surveillance system does not follow individual patients over time to record further disease development and final outcome. Haemolytic uremic syndrome (HUS) became a notifiable disease in December 2006. Before that, HUS was not notifiable per se, but was reported in relation to an EHEC diagnosis.

#### Case definition

A case from which enterohaemorrhagic *E. coli* or its toxins have been detected from faecal samples.

#### Diagnostic/analytical methods used

Clinical microbiological laboratories use plating on selective media (such as SMAC) in order to detect presumptive VTEC O157 and/or genetic methods directed towards detection of Shiga toxin genes followed by isolation of VTEC and confirmation at the National Reference Laboratory. Confirmation includes examination for the presence of Shiga toxin genes and other virulence factors.

#### Notification system in place

According to the Communicable Disease Act, human cases are notifiable to the Norwegian Surveillance System for Communicable Diseases (MSIS) since 1995. Haemolytic uremic syndrome (HUS) became a notifiable disease in December 2006.

#### History of the disease and/or infection in the country

The reported incidence of VTEC infections in humans in Norway has traditionally been low, but has increased during the last years. The number of cases has varied between 0-51 per year, except in 2009 with 108 reported cases. Approximately half of the cases are acquired domestically. Most reported cases are caused by VTEC O157.

The first foodborne VTEC outbreak in Norway occurred in 1999 and involved four culture positive patients (O157). Epidemiological investigations incriminated domestically produced lettuce as the most likely source of infection. A severe outbreak caused by VTEC O103:H25 in 2006 involved 17 patients of which 10 developed HUS and one died. In 2009, an outbreak caused by sorbitol fermenting O157:H- occurred. Thirteen children got ill, and of these nine developed HUS and one child died. The source of the outbreak was not found.

#### Results of the investigation

In 2011, 47 cases (incidence rate 1.0 per 100.000) of VTEC and HUS were reported. A total of 6 cases of HUS were reported; sorbitol fermenting O157:H- was isolated from one patient, sorbitol negative O157:H- from one patient, O145:H? from one patient, and in 3 patients VTEC was not isolated. Of the 47 cases of VTEC infections reported, the most commonly isolated serotypes were O157 (11 cases), O? (10 cases) and O103 (7 cases). A total of 13 of the 47 cases reported contracting the infection abroad. No outbreak was reported.

#### National evaluation of the recent situation, the trends and sources of infection

The number of cases reported in 2011 is lower than the cases reported in 2010, and much lower than the cases reported in 2009. In 2011, no outbreak has been reported. One outbreak counting three HUS cases was reported in 2010, as opposed to the seven outbreaks reported in 2009. Many of the notified cases in 2009 were detected because of increased attention and testing due to the outbreaks. The laboratory methods have probably improved since the O103 outbreak Norway experienced in 2006. Even though there is a small decrease from 2010 to 2011, the 47 cases of VTEC and 6 cases of HUS reported in 2011 reflects an increasing trend for EHEC in Norway. The reason for this increase is unknown.

#### Relevance as zoonotic disease

Data show that VTEC is present in the cattle and sheep populations, although the prevalences seem to be low. However, there is also a reservoir of *E. coli* with *eae*, but *stx* negative, that may be of concern as human pathogenics (aEPEC) or as precursors for VTEC. Thus, there is a potential for contamination in the food chain or by direct animal contact, which requires alertness at all steps from primary production, through processing, and retail and food preparation, as well as alertness among physicians and diagnostic laboratories.

#### Additional information

Patients whose work represents a risk for spread of the disease, e.g., people working with food production, children in day-care and health care personell, are advised to stay away from work while they have symptoms. It is recommended that for these patients five consecutive faecal samples examined after the symptoms have disappeared should be negative before returning to work.



## *Verotoxigenic E. coli (VTEC) in food and animals*

### Monitoring system

Prevalence surveys in cattle, sheep and goats have been conducted occasionally since 1998. In 2006-2007 a survey regarding *E. coli* in sheep was conducted, with a total of 593 flocks sampled. Single faecal samples were collected from the 50 youngest animals in each flock.

### Type of specimen taken

*Animals at farm*: Faeces

### Case definition

An animal or herd from which VTEC is isolated.

### Diagnostic/analytical methods used

ISO/TS 13136 (Draft method) Microbiology of food and animal feed - Real-time polymerase chain reaction (PCR)-based method for the detection of food-borne pathogens - Horizontal method for the detection of Shiga toxin-producing *Escherichia coli* (STEC) belonging to O157, O111, O26, O103 and O145 serogroups. If positive by PCR, isolation is attempted using a modified NMKL no. 164:1999 with AIMS (or AIMS-ELISA) followed by virulence characterization by PCR.

### Measures in case of the positive findings or single cases

If VTEC O157 or other VTEC that can pose a health risk for humans is detected in an official survey among live animals, the Norwegian Food Safety Authority and Municipal Medical Officer are notified. Restrictions may be imposed on livestock holdings where such VTEC is detected. The holdings sampled in the survey of sheep flocks in 2006-2007 were anonymized.

### Notification system in place

Findings in carcasses of VTEC O157 or other VTEC that can pose a health risk to humans lead to condemnation of the carcasses and notification to the authorities. Findings of such VTEC in samples from live animals are not notifiable as an animal disease, but since VTEC is a pathogen that can be transmitted from animals to humans, competent authorities have to be informed about positive findings.

### Results of the investigation

In 2011 a total of 48 samples, mainly from food but also some from animals and environment were investigated at the Norwegian Veterinary Institute due to follow up of human cases. Even though two VTEC isolates (O103:H2 (stx1 and eae positive) and O157:H- (stx1, stx2 and eae positive) were found, definite links between human cases and the samples from food, animals and environment were not identified.

### National evaluation of the recent situation, the trends and sources of infection

The prevalence of human pathogenic VTEC O157, O103, O26, O45 and O111 is still considered low in Norwegian cattle, sheep and goats.

# Tuberculosis, mycobacterial diseases

## *General evaluation of the national situation*

### History of the disease and/or infection in the country

Norway has been granted the officially tuberculosis-free status of bovine herds by the EFTA Surveillance Authority (ESA) (EFTA Surveillance Authority Decision No 28/07/COL) as Norway fulfils the requirements laid down in Council Directive 64/432/EEC as amended. Bovine tuberculosis (*M. bovis*) was declared eliminated in cattle in Norway in 1963 as a result of an official eradication programme against the disease. During the period 1895-1896, 26% of 2195 tuberculin-tested herds were positive. In 1950, 18 herds were registered as being infected, while in the beginning of the 1960s only one or two infected herds were reported annually. Since bovine tuberculosis was declared eliminated, it has only been recorded three times; in 1984 in two cattle herds and in 1986 in one cattle herd. These herds were in the same geographical area and the origin of the infection in these herds was probably a man with tuberculosis. Tuberculosis caused by *M. bovis* in other animal species than cattle has not been recorded in Norway after the disease was eliminated from cattle in 1963. Tuberculosis in humans caused by *M. bovis* is only sporadically recorded in Norway, and since 1977 the few recorded cases have been imported, except for one case of reactivation in 1994.

### National evaluation of the recent situation, the trends and sources of infection

As Norway is officially free from bovine tuberculosis, the probability of contracting *M. bovis* infection from Norwegian animals or animal products of Norwegian origin is close to zero.

### Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases

There have been no findings of *M. bovis* in animals or foodstuffs. The probability of contracting *M. bovis* infection from Norwegian animals or animal products of Norwegian origin is close to zero.

## *Tuberculosis due to Mycobacterium bovis in humans*

### Reporting system in place for the human cases

Human cases are reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), from microbiological laboratories as well as from clinical doctors. The system distinguishes between Norwegian and foreign born cases. The severity of the disease at the time of reporting is also recorded. The surveillance system includes individual treatment outcome data for all tuberculosis patients.

### Case definition

A confirmed case of *M. bovis*, *M. tuberculosis*, or *M. africanum* is a case that has been confirmed by isolation of *M. bovis*, *M. tuberculosis*, or *M. africanum*, respectively. Cases of tuberculosis that are diagnosed without laboratory confirmation (diagnoses based on clinical symptoms and X-ray examination) are also notified and included in the statistics.

### Diagnostic/analytical methods used

Clinical indications: Bacteriology, X-ray, pathology.

Screening: Miniature X-ray, tuberculin skin testing, Interferon gamma release assays.

### Notification system in place

According to the Communicable Disease Act, human cases caused by bacilli belonging to the *M. tuberculosis* complex (including *M. tuberculosis*, *M. bovis*, and *M. africanum*) are notifiable to the Norwegian Surveillance System for Communicable Diseases (MSIS) since 1975, and before that notifiable to a separate Tuberculosis Register since 1900.

### History of the disease and/or infection in the country

The incidence of human tuberculosis (*M. bovis* and *M. tuberculosis*) has steadily decreased during the last 50 years in persons of Norwegian origin. BCG vaccination was introduced in 1947 and was mandatory until 1995. Pasteurisation of milk for commercial sale became mandatory in 1951. Since 1977, the annual incidence rate in persons born in Norway has decreased from 11 to 1.4 per 100 000, and most cases in this part of the population are recurrent cases in elderly patients. Along with increased immigration to Norway, the proportion of tuberculosis cases involving persons born outside Norway has increased during the last two decades (from less than 10% in 1977 to 81% in 2006). Since bovine tuberculosis in cattle was eliminated in Norway in 1963, almost all bacteriologically confirmed cases in humans have been caused by *M. tuberculosis*. The last domestic case of tuberculosis caused by *M. bovis* was reported in 1994 in a 100 year old woman infected in her youth. Apart from this case, no indigenous cases of tuberculosis caused by *M. bovis* in humans have been reported since 1977. Imported cases of tuberculosis caused by *M. bovis* are sporadically reported; in 2010 in one patient from Africa, in 2005 in two patients from Somalia and Afghanistan, respectively, in 2002 in one patient from Somalia, in 2001 in one patient from Tanzania, in 2000 in two patients from Somalia and Morocco, respectively, in 1999 in one patient from Sri Lanka, in 1998 in one patient from Somalia, and in 1994 in one patient infected in India.

### Results of the investigation

In 2011, two cases with tuberculosis caused by *M. bovis* was notified. One patient was infected in Iraq and the other patient in Italy.

### National evaluation of the recent situation, the trends and sources of infection

Tuberculosis caused by *M. bovis* is only sporadically recorded in Norway, and except for a case of reactivation in 1994, the few recorded cases reported since 1977 have been imported.

### Relevance as zoonotic disease

As Norway is officially free from bovine tuberculosis, the probability of contracting *M. bovis* infection from Norwegian animals or animal products of Norwegian origin is close to zero.

### Additional information

In Norway, the child vaccination programme has included vaccination against tuberculosis since 1947. The BCG vaccine (live attenuated *M. bovis*) is offered to unvaccinated and tuberculin negative persons belonging to certain risk groups; immigrants from countries with high prevalence of tuberculosis, persons travelling to high endemic areas for a prolonged time period, teachers, health personnel, personnel on ships and in offshore industry, and military personnel. In addition, the BCG vaccine is offered to all children during junior high school (13-14 years old). In general, the immunisation coverage in Norwegian children is high; for the BCG vaccine it is estimated to be 99%. In Norway, the BCG vaccine is estimated to give 80% protection against tuberculosis. Tuberculin skin test is mandatory for immigrants coming to Norway from high prevalence countries. Immigrants who are 15 years or older must also undergo chest radiograph screening. Screening for tuberculosis in certain risk populations is sometimes conducted.

## *Mycobacterium in animals*

### A. *Mycobacterium bovis* in bovine animals

Status as officially free of bovine tuberculosis during the reporting year: The entire country free Norway has been granted the officially tuberculosis free status of bovine herds by the EFTA Surveillance Authority (ESA) (EFTA Surveillance Authority Decision No 28/07/COL) as Norway fulfils the requirements laid down in Council Directive 64/432/EEC as amended.

#### Monitoring system

Every slaughtered animal, except animals slaughtered for on-the-farm consumption, is subjected to meat inspection regarding tuberculosis (lymph node examination) according to Regulation (EC) No 854/2004. All breeding bulls are tuberculin tested several times. Imported animals are tuberculin tested if considered relevant based upon individual assessment. If suspicion arises whether an animal may have tuberculosis (sick or dead animal), relevant tests will be carried out.

#### Frequency of the sampling

All slaughtered animals are subject to meat inspection. Imported animals are tested during week 22 of the six months long isolation period. Breeding bulls are tuberculin tested before being transferred to a semen collection centre and thereafter subject to yearly testing.

#### Type of specimen taken

Animals for slaughter: Lymph nodes or organs with suspicious lesions. Breeding animals and imported animals: Tuberculin testing.

#### Methods of sampling (description of sampling techniques)

Slaughtered animals: Meat inspection at the slaughterhouse; lymph node examination. Imported animals and breeding animals: Tuberculin testing. Clinical indication: Methods vary depending on the problem.

#### Case definition

A single animal from which *M. bovis* or *M. tuberculosis* has been isolated. Herd is the epidemiological unit.

#### Diagnostic/analytical methods used

Slaughtered animals: Meat inspection regarding tuberculosis (lymph node examination) according to Regulation (EC) No 854/2004. If indicated: bacteriology and histology. Clinical indications: Tuberculin testing (intradermal comparative test), pathology, and/or bacteriology. Breeding animals and imported animals: Tuberculin testing (intradermal comparative test).

#### Vaccination policy

Vaccination of animals against tuberculosis is prohibited in Norway.

#### Control program/mechanisms

Every slaughtered animal, except animals slaughtered for on-the-farm consumption, is subjected to meat inspection regarding tuberculosis (lymph node examination) according to Regulation (EC) No 854/2004.

#### Measures in case of the positive findings or single cases

Norway would as a minimum implement the measures as laid down in Council Directive 64/432/EEC as amended in case of positive findings or if suspicion of tuberculosis in bovine animals should arise.

#### Notification system in place

Tuberculosis caused by *M. bovis* or *M. tuberculosis* of all species has been a notifiable List B disease according to the Animal Diseases Act since 1894.

#### Results of the investigation

In 2011, one slaughtered bovine animal had findings at slaughter indicating tuberculosis, and was submitted for examination for *Mycobacterium* sp. The samples were negative. A total of 252 bulls owned by a breeding company all had negative tuberculin tests.

#### National evaluation of the recent situation, the trends and sources of infection

Bovine tuberculosis was declared eliminated in cattle in 1963.

Relevance of the findings in animals to findings in foodstuffs and to human cases  
There have been no findings of *M. bovis* in animals or foodstuffs. The risk for humans contracting tuberculosis from livestock within the country is negligible.

#### B. *Mycobacterium bovis* in farmed deer

##### Monitoring system

Every slaughtered animal, except animals slaughtered for on-the-farm consumption, is subjected to meat inspection regarding tuberculosis (lymph node examination) by an official veterinarian according to Regulation (EC) No 854/2004. Imported deer are to be tuberculin tested. If suspicion arises whether an animal may have tuberculosis (sick or dead animal), relevant tests will be carried out.

##### Frequency of the sampling

All slaughtered animals are subject to meat inspection. Imported deer are tested during week 5 of the two months long isolation period.

##### Type of specimen taken

Animals for slaughter: Lymph nodes or organs with suspicious lesions. Imported animals: Tuberculin testing.

##### Methods of sampling (description of sampling techniques)

Slaughtered animals: Meat inspection at the slaughterhouse; lymph node examination. Imported animals: Tuberculin testing. Clinical indications: Methods will vary depending on the problem.

##### Case definition

A single animal from which *M. bovis* or *M. tuberculosis* has been isolated. The herd is the epidemiological unit.

##### Diagnostic/analytical methods used

Slaughtered animals: Meat inspection regarding tuberculosis (lymph node examination) by an official veterinarian according to Regulation (EC) No 854/2004. If indicated: bacteriology and histology. Imported animals: Tuberculin testing (intradermal comparative test). Clinical indications: Tuberculin testing (intradermal comparative test), pathology, and/or bacteriology.

##### Vaccination policy

Vaccination of animals against tuberculosis is prohibited in Norway.

##### Control program/mechanisms

Every slaughtered animal, except animals slaughtered for on-the-farm consumption, is subjected to meat inspection regarding tuberculosis (lymph node examination) by an official veterinarian according to Regulation (EC) No 854/2004. Required autopsy of animals older than 12 months of age that die or are killed because of a disease.

##### Measures in case of the positive findings or single cases

Norway would as a minimum implement the measures as laid down in Council Directive 64/432/EEC as amended in case of positive findings or if suspicion of tuberculosis should arise.

##### Notification system in place

Tuberculosis caused by *M. bovis* or *M. tuberculosis* of all species has been a notifiable List B disease according to the Animal Diseases Act since 1894.

##### Results of the investigation

In 2011, no farmed deer had suspect findings at slaughter.

##### National evaluation of the recent situation, the trends and sources of infection

Bovine tuberculosis has never been diagnosed in farmed or wild deer in Norway. The Norwegian population of farmed deer is small.

##### Relevance of the findings in animals to findings in foodstuffs and to human cases

There have been no findings of *M. bovis* in animals or foodstuffs. The risk for humans contracting tuberculosis from livestock within the country is negligible.

### C. *Mycobacterium* spp. in other animals

#### Monitoring system

For cattle and farmed deer, see the respective chapters. Every slaughtered animal, except poultry and animals slaughtered for on-the-farm consumption, is subjected to meat inspection regarding tuberculosis (lymph node examination) by an official veterinarian according to Regulation (EC) No 854/2004. Imported animals are tuberculin tested if considered relevant based upon individual assessment. Boars selected for export of semen to USA are tuberculin tested. If suspicion arises whether an animal may have tuberculosis (sick or dead animal), relevant tests will be done.

#### Frequency of the sampling

All slaughtered animals are subject to meat inspection. Imported animals: Sheep and goats are tested during week 23 of the two years long isolation period. Llamas and alpacas are tested during week 22 of the six months long isolation period. Pigs are tested during week 7 of the two months long isolation period if considered relevant based upon individual assessment.

#### Type of specimen taken

Animals for slaughter: Lymph nodes or organs with suspicious lesions.  
Imported or exported animals: Tuberculin testing.

#### Methods of sampling (description of sampling techniques)

Slaughtered animals: Meat inspection at the slaughterhouse; lymph node examination. Imported animals: Tuberculin testing. Clinical indications: Methods will vary depending on the problem.

#### Case definition

A single animal from which *M. bovis* or *M. tuberculosis* has been isolated. The herd is the epidemiological unit.

#### Diagnostic/analytical methods used

Slaughtered animals: Meat inspection regarding tuberculosis (lymph node examination) by an official veterinarian according to Regulation (EC) No 854/2004. If indicated: bacteriology and histology. Tests of imports, exports: Tuberculin testing (intradermal comparative test). Clinical indications: Tuberculin testing (intradermal comparative test), pathology, and/or bacteriology.

#### Vaccination policy

Vaccination of animals against tuberculosis is prohibited.

#### Control program/mechanisms

Every slaughtered animal, except poultry and animals slaughtered for on-the-farm consumption, is subjected to meat inspection regarding tuberculosis (lymph node examination) by an official veterinarian according to Regulation (EC) No 854/2004.

#### Measures in case of the positive findings or single cases

Norway would as a minimum implement the measures as laid down in Council Directive 64/432/EEC as amended in case of positive findings or if suspicion of tuberculosis should arise.

#### Notification system in place

Tuberculosis caused by *M. bovis* or *M. tuberculosis* in all species has been a notifiable List B disease according to the Animal Diseases Act since 1894. Cases are to be notified to the Norwegian Food Safety Authority.

#### Results of the investigation

In 2011, tuberculin tests were performed on 93 breeding boars at AI stations, all were negative. Samples from three sheep, 14 pigs, 40 alpacas (faecal samples) and one pet rat were analyzed for the presence of *Mycobacterium* species. A total of 10 pigs were positive for *M. avium* "hominissuis" and three alpacas were positive for *M. engbaekii*.

#### National evaluation of the recent situation, the trends and sources of infection

Bovine tuberculosis was declared eliminated in cattle in 1963, and has since then not been recorded in other animal species.

#### Relevance of the findings in animals to findings in foodstuffs and to human cases

There have been no findings of *M. bovis* in animals or foodstuffs. The risk for humans contracting tuberculosis from livestock within the country is negligible.

# Brucellosis

## *General evaluation of the national situation*

### History of the disease and/or infection in the country

Bovine brucellosis has been a notifiable disease since 1903. An offensive eradication programme to eliminate the disease was launched in 1935, and Norway was declared free from bovine brucellosis in 1953. Ovine, caprine, or porcine brucellosis has never been recorded in Norway. Norway has been granted official brucellosis-free status of bovine herds by the EFTA Surveillance Authority (ESA) (EFTA Surveillance Authority Decision No 28/07/COL). Also regarding *Brucella melitensis*, Norway fulfils the requirements for an officially free status for the disease in sheep and goats, however, a formal decision is not available. Human brucellosis has always been a rare disease in Norway, the majority of the cases being imported, and a few cases due to laboratory infections domestically.

### National evaluation of the recent situation, the trends and sources of infection

As bovine brucellosis was declared eliminated in Norway in 1953, and ovine, caprine, or porcine brucellosis has never been recorded, Norway is considered free from brucellosis in production animals. Research studies have shown that antibodies against *Brucella* can be detected in marine mammals (minke whales and hooded seals) from the North Atlantic Ocean, and in polar bears from the archipelago of Svalbard and the Barents Sea. *Brucella* sp. different from previously described species has also been isolated from hooded seals from the Greenland Sea.

### Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases

There have been no findings of *Brucella* spp. in terrestrial animals or foodstuffs. The probability of contracting brucellosis from Norwegian animals or animal products of Norwegian origin is close to zero.

## *Brucellosis in humans*

### Reporting system in place for the human cases

Human cases are reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), from microbiological laboratories as well as from clinical doctors. The system distinguishes between domestic and imported cases. The severity of the disease at the time of reporting is also recorded. However, the surveillance system does not follow individual patients over time to record further disease development and final outcome.

### Case definition

A clinically compatible case that is laboratory confirmed.

### Diagnostic/analytical methods used

Serology (serum antibody test or antigen test of clinical specimen) and bacteriology (isolation).

### Notification system in place

According to the Communicable Disease Act, human cases are notifiable to the Norwegian Surveillance System for Communicable Diseases (MSIS) since 1975.

### History of the disease and/or infection in the country

Human brucellosis has always been a rare disease in Norway, and mainly sporadic imported cases are reported (0-3 cases annually). During the period 1978-2011, only 28 cases of brucellosis were reported.

### Results of the investigation

In 2011 two cases were reported. Both cases were infected abroad.

### National evaluation of the recent situation, the trends and sources of infection

Brucellosis is rarely recorded in Norway. Since 1978, only 28 cases have been recorded and only two of these are known to be infected in Norway, both laboratory contracted.

### Relevance as zoonotic disease

As Norway is free from brucellosis in terrestrial food producing animals, the risk of humans contracting brucellosis from such animals or from Norwegian animal products is considered negligible. However, the recent findings of *Brucella* species in marine mammals warrants further research to better understand the epidemiology and to address possible public health implications.

## *Brucella in animals*

## A. *Brucella abortus* in bovine animals

Status as officially free of bovine brucellosis during the reporting year: The entire country free Norway is regarded as officially free from bovine brucellosis according to the EFTA Surveillance Authority (ESA) (EFTA Surveillance Authority Decision No 28/07/COL).

### Monitoring system

Surveillance programme: During the years 2000-2004, the programme consisted of an active surveillance part, where 20% of the Norwegian cattle population were sampled each year, and a passive surveillance part, where aborted foetuses and blood samples from their dams were investigated. Since 20% of the Norwegian cattle population had been tested annually for five consecutive years and thereby fulfilled the requirements from the EU, the programme in 2005 was reduced to passive surveillance only. According to the programme, all abortions between the fifth month of pregnancy and 14 days before expected birth in a herd in which there has been at least two such abortions the last 12 months, should be sampled. In addition, blood samples from the cow should be examined. All breeding bulls are tested. Imported animals are serologically tested if considered relevant, based upon an assessment of the health status in the country of origin. Tests are also carried out in connection with clinical indications and export.

### Frequency of the sampling

All breeding bulls are tested serologically twice before being transferred to a semen collection centre, and subsequently retested within 12 months. Bulls are thereafter subject to yearly testing. Imported cattle are tested at week 22 during the six months long isolation period.

### Type of specimen taken

Blood or foetus.

### Methods of sampling (description of sampling techniques)

Surveillance programme: Foetus and the foetal membranes and paired blood samples from the mother are collected. Other monitoring systems: Blood samples. All samples are collected at farm.

### Case definition

An animal which is seropositive for *Brucella* spp. even after retesting at least four weeks later, or an animal from which *Brucella* spp. has been isolated. The herd is the epidemiological unit.

### Diagnostic/analytical methods used

Foetus: Full autopsy, histopathology, bacteriology. Blood samples from cows: Antibodies against *Brucella* in an indirect ELISA (Svanova). If the results are doubtful or positive, the samples are retested in duplicates. If the result still is doubtful or positive, the sample is tested with a competitive ELISA (C-ELISA, Svanova). If still positive, a complement fixation (CF) test is used. If the CF test is positive, new samples are taken four to six weeks after the initial sampling. If this is positive, or if there is a need for immediate follow up, the animal will be tested with an intracutane test using Brucellergene OCB from *B. melitensis* (Synbiotics). Breeding animals, imports, exports: Serology (Rose Bengal plate agglutination test, serum agglutination test or complement fixation test depending on the customer's demands). All tests are performed according to the OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals, 5th ed. 2004. The indirect ELISA is standardized against EU Directive 64/432/EEC Annex C.

### Vaccination policy

Vaccination of animals against brucellosis is prohibited in Norway.

### Control program/mechanisms

The surveillance programme in cattle herds (in accordance to Council Directive 64/432/EEC Annex I) was established in 2000. All breeding bulls are serologically tested twice before being transferred to a semen collection centre, and subsequently within 12 months. Bulls are thereafter subjected to yearly testing. Imported cattle are serologically tested if considered relevant based upon an individual assessment. Tests are also carried out in connection with clinical indications and export.

### Measures in case of the positive findings or single cases

Norway would as a minimum implement the measures as laid down in Council Directive 64/432/EEC as amended in case of positive findings or if suspicion of brucellosis in bovine animals should arise.



### Notification system in place

Bovine brucellosis has been a notifiable List A disease according to the Animal Diseases Act since 1903. Cases are to be notified to the Norwegian Food Safety Authority.

### Results of the investigation

In 2011, 22 herds were investigated in the surveillance programme (blood samples, aborted fetuses). A total of 355 bulls owned by one breeding company and 22 bulls from another company were tested for brucellosis. All samples were negative.

### National evaluation of the recent situation, the trends and sources of infection

Bovine brucellosis was eliminated from Norway in 1953. No positive cases have been found since then.

### Relevance of the findings in animals to findings in foodstuffs and to human cases

There have been no findings of *Brucella* spp. in cattle or foodstuffs from cattle. The probability of contracting brucellosis from Norwegian animals or animal products of Norwegian origin is close to zero.

Table *Brucella* spp. in animals

	Source of information <sup>1</sup>	Sampling unit	Units tested	Total units positive for <i>Brucella</i> spp.
<b>Cattle</b>	Surveillance programme	Herd	22	0
	BC/NVI	Animal	377	0
<b>Sheep</b>	Surveillance programme	Animal	13639	0
	BC/NVI	Animal	86	0
	NVI	Animal	40	0
<b>Goats</b>	Surveillance programme	Animal	2698	0
	NVI	Animal	9	0
<b>Pigs</b>	BC	Animal	1244	0
<b>Dogs</b>	NVI	Animal	23	0
<b>Alpacas</b>	NVI	Animal	28	0

<sup>1</sup> BC = Breeding Companies, NVI=Norwegian Veterinary Institute (mainly tested in relation to export or import)

## B. *Brucella melitensis* in sheep and goats

Status as officially free of ovine brucellosis during the reporting year: The entire country free  
Due to its history in regard to *Brucella melitensis*, Norway fulfils the requirements for an officially free status for the disease.

### Monitoring system

Surveillance programme : Randomly selected sheep and goat herds are tested.  
Imported sheep and goats are serologically tested if considered relevant based upon an assessment of the health status in the country of origin.

### Frequency of the sampling

Surveillance programme: A selection of herds in the population is tested every year. Imported sheep and goats are tested for brucellosis at week 2 and 23 during the two year isolation period.

### Type of specimen taken

Blood

### Methods of sampling (description of sampling techniques)

Individual blood samples are collected at farm. Surveillance programme: In flocks with less than 30 animals, all animals are sampled; in herds with 30-100 animals, 30 are sampled; in herds with 100-200 animals, 35 are sampled; in herds with more than 200 animals, 40 animals are sampled.

### Case definition

An animal which is seropositive for *Brucella* spp. or an animal from which *Brucella* spp. has been isolated. The herd is the epidemiological unit.

### Diagnostic/analytical methods used

Rose Bengal plate agglutination test is used for the initial screening. A competitive ELISA (C-ELISA, Svanova) is used to follow up unclear or positive reactions due to possible cross reactions.

### Vaccination policy

Vaccination of animals against brucellosis is prohibited.

### Control program/mechanisms

The national surveillance programme and the control of imported animals are run by the Norwegian Food Safety Authority.

### Measures in case of the positive findings or single cases

Norway would as a minimum implement the measures as laid down in Council Directive 91/68/EEC in case of positive findings or if suspicion of brucellosis in ovine or caprine animals should arise.

### Notification system in place

Brucellosis in all species has been a notifiable List A disease according to the Animal Diseases Act since 1903. Cases are to be notified to the Norwegian Food Safety Authority.

### Results of the investigation

Sheep: In 2011, in the surveillance programme, 13639 animals from 467 herds were tested for antibodies against *B. melitensis*. All were negative. All 86 rams tested for brucellosis were negative. A total of 40 animals tested in relation to import or trade were negative.

Goats: In 2011, in the surveillance programme, 2698 animals from 93 herds were tested for antibodies against *B. melitensis*. A total of nine animals (at a Circus) were tested in relation to import. All were negative.

### National evaluation of the recent situation, the trends and sources of infection

Ovine or caprine brucellosis has never been recorded in Norway.

### Relevance of the findings in animals to findings in foodstuffs and to human cases

There have been no findings of *Brucella* spp. in sheep or goats or foodstuffs from sheep or goats. The probability of contracting brucellosis from Norwegian animals or animal products of Norwegian origin is close to zero.

## C. *Brucella* spp. in pigs

### Monitoring system

All breeding boars are tested. Imported pigs are tested if considered relevant based upon an individual assessment.

### Frequency of the sampling

All breeding boars are tested twice before being transferred to a semen collection centre, and subsequently within 12 months or before slaughter. Imported pigs are tested during week 4 of the two months long isolation period.

### Type of specimen taken

Blood

### Methods of sampling (description of sampling techniques)

Blood samples are taken at the farms.

**Case definition** An animal which is seropositive for *Brucella* spp. or an animal from which *Brucella* spp. has been isolated. The herd is the epidemiological unit.

### Diagnostic/analytical methods used

Rose Bengal plate agglutination test performed according to the latest edition of the OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals, 2.8.5 Swine.

### Vaccination policy

Vaccination of animals against brucellosis is prohibited in Norway.

### Control program/mechanisms

All breeding boars are tested. Imported pigs are tested if considered relevant based upon an individual assessment.

### Measures in case of the positive findings or single cases

If *Brucella* should be detected, the competent authorities must be notified without delay. Actions would be taken to identify and eliminate the source of the contamination in order to prevent further spread. Stringent restrictions including cleaning and disinfection, control of animal movement and control of person admission would be imposed on the infected holding. The whole herd would be destroyed.

### Notification system in place

Brucellosis in all species has been a notifiable List A disease according to the Animal Diseases Act since 1903. Cases are to be notified to the Norwegian Food Safety Authority.

### Results of the investigation

In 2011, all 1244 investigated pigs belonging to a breeding company tested negative. A total of 119 of these were tested in relation to export of live animals.

### National evaluation of the recent situation, the trends and sources of infection

Porcine brucellosis has never been recorded in Norway.

### Relevance of the findings in animals to findings in foodstuffs and to human cases

There have been no findings of *Brucella* spp. in swine or foodstuffs from swine. The probability of contracting brucellosis from Norwegian animals or animal products of Norwegian origin is close to zero.

# Yersiniosis

## *General evaluation of the national situation*

### History of the disease and/or infection in the country

In the years 1982-1994, the number of notified cases in humans varied between 154 and 274 (mean 187). From 1994 there was a steady decline in the reported incidence of yersiniosis. The decline was interrupted in 1998, and since then the incidence has been between 50 and 150 notified cases per year.

Studies conducted during the 1980s revealed that a large proportion of Norwegian pigs were carriers of *Y. enterocolitica* serogroup O:3, and that the same variant frequently could be isolated from pig carcasses. In 1995-1996 a serological survey of all multiplier herds (n=66) belonging to the cooperative slaughterhouse organisation showed that 35.5% of the fattening pigs had antibodies against *Y. enterocolitica* O:3, and 80% of the herds had at least one pig (of 40 pigs tested per herd) with antibodies against *Y. enterocolitica* O:3. In another survey where blood samples from 5 fatteners in each of 326 randomly selected herds were analysed for antibodies against *Y. enterocolitica* O:3, 53% of the pigs and 64% of the herds tested positive.

In 1997-1998, 300 samples of raw pork products were analyzed. *Y. enterocolitica* O:3 was isolated from 2% of the samples by a culturing method (NMKL method no. 117), while use of a PCR method indicated the presence of pathogenic *Y. enterocolitica* in 17% of the samples. This was lower than in a similar survey conducted in 1988-1989.

### National evaluation of the recent situation, the trends and sources of infection

From 1994 to 1998, a reduction in the incidence of yersiniosis in humans was observed. This decline coincided with a gradual introduction of improved slaughter routines with the aim of preventing pig carcasses from becoming contaminated with *Y. enterocolitica*.

### Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases

Pork products are generally considered the most important source of yersiniosis in humans. A Norwegian case control study conducted in the period 1988-1990 identified consumption of such products as an important risk factor in addition to consumption of untreated drinking water and a general preference for undercooked meat. In 2006 two smaller outbreaks of yersiniosis both linked to a traditional cold cuts pork product were reported.

### Recent actions taken to control the zoonoses

During the mid 1990s, there was a gradual introduction of improved slaughter routines that aid in preventing pig carcasses from being contaminated with *Y. enterocolitica*. A significant reduction of reported cases of human yersiniosis cases was noted parallel to this.

## *Yersiniosis in humans*

### Reporting system in place for the human cases

Human cases are reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), from microbiological laboratories as well as from clinical doctors. The system distinguishes between domestic and imported cases. The severity of the disease at the time of reporting is also recorded. However, the surveillance system does not follow individual patients over time to record further disease development and final outcome. Cases confirmed by serology only are also reported, but due to recent changes in laboratory practices these are not included in this report.

### Case definition

A case from which *Y. enterocolitica* or *Y. pseudotuberculosis* has been isolated or a clinical compatible case with an epidemiological link to a culture confirmed case.

### Diagnostic/analytical methods used

Bacteriology (isolation of *Yersinia* species) followed by voluntary confirmation (species identification and serotyping) at the National Reference Laboratory.

### Notification system in place

According to the Communicable Disease Act, human cases are notifiable to the Norwegian Surveillance System for Communicable Diseases (MSIS) since 1992.

#### History of the disease and/or infection in the country

In the years 1982-1994, the number of notified cases varied between 154 and 274 (mean 187, median 182). From 1994 there was a steady decline in yersiniosis reports. This decline coincided with a gradual introduction of improved routines when slaughtering pigs, which resulted in reduced contamination with *Y. enterocolitica* to pig carcasses. The decline was interrupted in 1998, and since then the incidence has been between 50 and 150 notified cases per year.

#### Results of the investigation

In 2011, a total of 60 cases of yersiniosis were reported (incidence rate 1.2 per 100 000), all caused by *Y. enterocolitica*. A total of 33 (55%) cases were domestic. One outbreak was reported.

#### National evaluation of the recent situation, the trends and sources of infection

Although the incidence of yersiniosis has decreased in recent years and the number of registered cases is moderate, the disease is still the fourth most commonly recorded foodborne zoonotic infection in Norway. Moreover, the majority of the cases have acquired the infection within Norway. The vast majority of cases are sporadic. The most common serogroup is O:3. The number of cases reported in 2011 is almost the same as in the previous three years, between 50-60 cases.

#### Relevance as zoonotic disease

Yersiniosis is an important zoonotic disease in Norway, with the majority of cases acquired within Norway. Pigs are considered to be a major reservoir, and pork products are considered to be an important source for pathogenic *Y. enterocolitica*, although uncertainties still remain regarding the epidemiology.

#### Additional information

Patients whose work represents a risk for spread of the disease, e.g., in food production and health care, are advised to stay away from work as long as they have symptoms. It is recommended that for these patients two consecutive faecal samples examined after the symptoms have disappeared should be negative before returning to work.

### *Yersinia in animals*

#### Monitoring system

There are no official monitoring programmes for *Y. enterocolitica* in live animals or in animals at slaughter.

#### Recent actions taken to control the zoonoses

During the mid 1990s, there was a gradual introduction of improved slaughter routines that aid in preventing pig carcasses from being contaminated with *Y. enterocolitica*. A significant reduction in the incidence of reported yersiniosis in humans was noted subsequent to this action.

#### Measures in case of the positive findings or single cases

None.

#### Results of the investigation

In 2011, two goats, two sheep, one cat and one wild hare were diagnosed with *Y. pseudotuberculosis*. One monkey from a zoo was diagnosed with *Y. enterocolitica*.

# Trichinellosis

## *General evaluation of the national situation*

### History of the disease and/or infection in the country

Trichinellosis has been found sporadically in farmed food producing animals and was last detected in two pig herds in 1994. This was the first report of trichinellosis in pigs since 1981. Trichinellosis occurs endemically among wild red foxes in mainland Norway and among wild arctic foxes and polar bears in the archipelago of Svalbard. In a survey in red foxes killed during the licensed hunting season in 1994-1995 and 2002-2005, 4.8% of 393 examined animals were positive for *Trichinella* larvae. *T. spiralis* and *T. pseudospiralis* were not found in these studies. *T. nativa* is the most commonly found species in Norwegian foxes. Trichinellosis has also been diagnosed in farmed foxes. Human trichinellosis acquired in Norway has not been reported since 1980. The two last reported cases of human trichinellosis, in 1996, were both imported.

### National evaluation of the recent situation, the trends and sources of infection

Trichinellosis was last detected in food producing animals in 1994, in two pig herds. Trichinellosis occurs endemically among wildlife.

### Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases

As Norwegian food producing animals very rarely are infected with *Trichinella*, and all slaughtered pigs and horses are analysed for the parasite, the probability of contracting trichinellosis from food producing animals of Norwegian origin is close to zero.

## *Trichinellosis in humans*

### Reporting system in place for the human cases

Human cases are reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), from microbiological laboratories as well as from clinical doctors. The system distinguishes between domestic and imported cases. The severity of the disease at the time of reporting is also recorded. However, the surveillance system does not follow individual patients over time to record further disease development and final outcome.

### Case definition

A clinically compatible case that is laboratory confirmed.

### Diagnostic/analytical methods used

Muscle biopsy and histopathology (demonstration of *Trichinella* larvae in tissue) and serology.

### Notification system in place

According to the Communicable Disease Act, human cases are notifiable to the Norwegian Surveillance System for Communicable Diseases (MSIS) since 1975.

### History of the disease and/or infection in the country

Human trichinellosis acquired in Norway is very rare, the last case being reported in 1980. The last two cases of imported trichinellosis were reported in 1996, in immigrants from ex-Yugoslavia.

### Results of the investigation

In 2011, no cases of human trichinellosis were reported.

### Relevance as zoonotic disease

The risk of acquiring trichinellosis from domestic sources is considered very low because trichinellosis only has been detected twice in food producing animals since 1981, extensive surveillance programmes are in place, and the production is intensive and takes place under controlled conditions.

### Additional information

If a human case should be diagnosed, epidemiological investigations will be initiated in order to identify the source and prevent further cases.

## *Trichinella* in animals

### A. *Trichinella* in pigs and horses

#### Monitoring system

All pigs and horses are controlled for *Trichinella* at slaughter according to Regulation (EC) No 2075/2005.

#### Frequency of the sampling

Every slaughtered animal is sampled.

#### Type of specimen taken

Pigs: Diaphragm muscle.

Horses: Tongue or masseter muscle.

#### Methods of sampling (description of sampling techniques)

Methods used are according to Regulation (EC) No 2075/2005.

Pigs: Up to 100 samples, each of 1 gram, can be analysed as a pooled sample.

Horses: 5 g per animal is included in a pooled sample of maximum 100 g.

#### Case definition

An animal with a positive test result in the official examination.

#### Diagnostic/analytical methods used

Artificial digestion method of pooled samples.

#### Preventive measures in place

It is prohibited to feed pigs with swills. Most pig herds have implemented programs for combating of rodents (rats and mice).

#### Control program/mechanisms

All pigs must be controlled for *Trichinella* at slaughter according to Regulation (EC) No 2075/2005.

#### Measures in case of the positive findings or single cases

Detection of *Trichinella* must be reported immediately. In accordance with Regulation No 732 of 27 June 2002 on measures against contagious animal diseases, measures, such as movement restrictions and investigations into the source of the disease and any spread, are imposed on holdings with positive findings of *Trichinella*.

Farms delivering positive carcasses will be identified. Animals from such farms will be given special attention at slaughter the following six months. The sample size for the digestion method will be increased to 2 grams.

#### Notification system in place

Trichinellosis has been a notifiable disease (List B) since 1965.

#### Results of the investigation

In 2011, no cases of trichinellosis among slaughtered pigs or horses were reported.

#### National evaluation of the recent situation, the trends and sources of infection

Trichinellosis was last detected in two pig herds in 1994.

#### Relevance of the findings in animals to findings in foodstuffs and to human cases

There have not been any findings of *Trichinella* in pigs or pig meat for many years. There have not been any findings of *Trichinella* in horses or horse meat. The risk of obtaining trichinellosis from Norwegian pig or horse meat is negligible.

## B. *Trichinella* spp. in wild animals

### Monitoring system

All wild boars and bears must be controlled for *Trichinella* at slaughter according to Regulation (EC) No 2075/2005. This control is compulsory. Wild and farmed foxes and other species of wildlife are occasionally sampled.

### Frequency of the sampling

Depending on the situation and animal species.

### Type of specimen taken

Diaphragm, tongue, masseter or occasionally other muscles.

### Methods of sampling (description of sampling techniques)

Depending on the situation and animal species.

### Case definition

An animal with a positive test result.

### Diagnostic/analytical methods used

Digestion methods.

### Measures in case of the positive findings or single cases

If trichinellosis is diagnosed in a farmed fox, the animal holding will get official restrictions in accordance with Regulations concerning measures against contagious diseases of 27.06.2002 no 732 (not allowed to sell animals and epidemiological investigation of the source and any spread of the infection).

### Notification system in place

Trichinellosis has been a notifiable disease since 1965.

### Results of the investigation

In 2011, 96 red foxes, three wolves, a bear and a wild boar were examined for *Trichinella* sp. One red fox tested positive for *Trichinella* sp., and *T. nativa* was identified. All the remaining animals were negative for *Trichinella* sp.

### National evaluation of the recent situation, the trends and sources of infection

Trichinellosis occurs endemically among wildlife.



# Echinococcosis

## General evaluation of the national situation

### History of the disease and/or infection in the country

*E. granulosus* used to be relatively common in semi-domesticated reindeer in North Norway until the 1950s (approx. 10% prevalence in the 1950s). Today the parasite has virtually been eliminated as a result of systematic antihelmintic treatment of herder dogs and a reduction in the feeding of raw offal from slaughter to the herder dogs. In 2003, one reindeer had pathological findings compatible with *E. granulosus* infestation. *E. granulosus* was last reported in cattle in 1987.

*E. multilocularis* has never been detected in mainland Norway in any animal species. In 1999, a research project on echinococcosis in the archipelago of Svalbard detected *E. multilocularis* cysts in the liver of 16% of 172 sibling voles tested. In a follow-up study, faecal samples from polar foxes, dogs, and cats were collected. The parasite was diagnosed in three of six polar foxes, in one of 48 dogs, but not in the two cats that were examined. The methods used were coproantigen ELISA, egg isolation and PCR. The number of voles from Svalbard that annually tested positive between 2000-2006, varied between 19% and 96%. In mainland Norway in the period 2002-2005, a total of 314 red foxes were investigated using coproantigen ELISA, egg isolation and PCR, all were negative for *E. multilocularis*. An ongoing national surveillance program for *E. multilocularis* was implemented in red foxes in 2006. Since then, 2166 foxes have been examined using egg isolation and PCR. All of the foxes have tested negative for *E. multilocularis*.

Human echinococcosis has never been a public health problem in Norway.

### National evaluation of the recent situation, the trends and sources of infection

The risk of acquiring echinococcosis in Norway is considered very low. The pathological finding compatible with *E. granulosus* infestation in a reindeer in 2003 is a reminder that this parasite still may be present and that this requires awareness in the reindeer industry, especially with regard to the importance of regular treatment of herd dogs with an antihelmintic drug. The occurrence of *E. multilocularis* among animals in the archipelago of Svalbard requires alertness among health personnel, especially in this region.

### Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases

The pathological finding compatible with *E. granulosus* infestation in a reindeer in 2003 is a reminder that this parasite still may be present and that this requires awareness in the reindeer industry.

As *E. multilocularis* has never been detected in mainland Norway in any animal species, the risk to humans of contracting *E. multilocularis* infection in mainland Norway is probably very low, even if *E. multilocularis* was detected in foxes in Sweden for the first time in 2011. The occurrence of *E. multilocularis* among animals in the archipelago of Svalbard requires alertness among health personnel in this region. Inhabitants of Svalbard have been informed about the risk.

## Echinococcosis in humans

### Reporting system in place for the human cases

Human cases are reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), from microbiological laboratories as well as from clinical doctors. The system distinguishes between domestic and imported cases. The severity of the disease at the time of reporting is also recorded. The surveillance system does not follow individual patients over time to record further disease development and final outcome.

### Case definition

A clinical compatible case that is laboratory confirmed.

### Diagnostic/analytical methods used

Serology and histopathology.

### Notification system in place

According to the Communicable Disease Act, human cases are notifiable to the Norwegian Surveillance System for Communicable Diseases (MSIS) since 1 July 2003.

### History of the disease and/or infection in the country

Human echinococcosis has never been a public health problem in Norway and the incidence is considered to be at most very low. The majority of cases have acquired the infection abroad.

#### Results of the investigation

In 2011, two cases of infection with *E. granulosus* and one with *E. sp.* was reported. The patients were infected abroad.

#### Relevance as zoonotic disease

The risk of acquiring echinococcosis in Norway is considered very low. The pathological finding compatible with *E. granulosus* infestation in a reindeer in 2003 is a reminder that this parasite still is present and that this requires awareness in the reindeer industry, especially as regard the importance of regular treatment of herd dogs with an antihelminthic drug. As *E. multilocularis* has never been detected in mainland Norway in any animal species, the risk to humans of contracting echinococcosis caused by *E. multilocularis* in mainland Norway is close to zero. The presence of *E. multilocularis* among animals in the archipelago of Svalbard requires vigilance amongst health personnel in this region. Inhabitants of Svalbard have been informed about the risk.

## Echinococcus in animals

### A. *E. granulosus* in animals

#### Monitoring system

Surveillance in intermediate hosts is achieved through the official meat inspection. There are no official monitoring programmes for *Echinococcus granulosus* among the final hosts (dogs).

#### Frequency of the sampling

All possible intermediate hosts subject to meat inspection procedure according to Regulation (EC) No 2075/2005. An exception to this is wild ruminants in which there is no obligatory control if they are shot for private consumption.

#### Methods of sampling (description of sampling techniques)

Inspection for hydatid cysts at the abattoir.

#### Case definition

An animal with a positive test result.

#### Diagnostic/analytical methods used

Macroscopic (visual) examination of organs and parasitology.

#### Other preventive measures than vaccination in place

Dogs and cats imported to Norway, except those imported from Sweden and Finland, must be treated with an anthelmintic drug the last ten days before entering Norway and again within one week after arrival. Treatment with an anthelmintic drug is also advocated on a general basis, especially for herd dogs in areas with reindeer.

#### Control program/mechanisms

Mandatory official meat control.

#### Measures in case of the positive findings or single cases

An animal with cystic echinococcosis will be condemned. Epidemiological data will be collected in order to find the source of infection and measures will be introduced to prevent further spread.

#### Notification system in place

Echinococcosis has been a notifiable List B disease according to the Animal Diseases Act since 1985.

#### Results of the investigation

In 2011, all slaughtered animals subjected to official meat control were negative for *E. granulosus*. No cases of infection with *E. granulosus* were diagnosed in carnivores.

#### Additional information

Methods in use when examining final hosts: Faecal material: Egg isolation (flotation) and PCR.

## B. *E. multilocularis* in animals

### Monitoring system

In 2006 a National surveillance programme regarding *E. multilocularis* in red foxes was started. The program also included the examination of samples from hunted foxes collected for parasitological research purposes in the period 2002-2005. There are no official monitoring programmes for *E. multilocularis* in other animals.

### Methods of sampling (description of sampling techniques)

Foxes: Faecal samples.

### Case definition

An animal with a positive test result.

### Diagnostic/analytical methods used

Faecal samples: Taeniid egg isolation and multiplex PCR techniques.

### Other preventive measures than vaccination in place

Dogs and cats imported to Norway, except those imported from Sweden (until March 2011) and Finland, must be treated with an anthelmintic drug within ten days before entering Norway as well as within one week after arrival. Treatment with an anthelmintic drug is also advocated on a general basis. Due to findings of *E. multilocularis* in the archipelago of Svalbard, the Norwegian Food Safety Authority requires that dogs and cats that are introduced into mainland Norway from Svalbard must be treated with an anthelmintic drug approved for treatment of *E. multilocularis*.

### Recent actions taken to control the zoonoses

The surveillance programme for red foxes was intensified, especially in areas close to the Swedish border, after the findings in Sweden in 2011. The findings of *E. multilocularis* in the archipelago of Svalbard in 1999 resulted in follow-up studies, requirements regarding anti-helminthic treatment of dogs and cats in regard to export, and an information campaign directed to the inhabitants of Svalbard.

### Notification system in place

Echinococcosis has been a notifiable List B disease according to the Animal Diseases Act since 1985.

### Results of the investigation

In 2011, in the surveillance programme for red foxes, a total of 533 animals hunted in the hunting season 2010-2011 were investigated. In addition, five dogs, four racoon dogs (*Nyctereutes procyonoides*), six raccoons (*Procyon lotor*) and three wolves were investigated. All animals were negative.

### National evaluation of the recent situation, the trends and sources of infection

In mainland Norway, *E. multilocularis* has never been detected in any animal species. The main host of *E. multilocularis*, the red fox, has been investigated by examining a total of 2166 foxes killed during hunting from 2002-2011. All foxes have been negative. Thus, there are so far no indications that this parasite has established in Norway. In 1999, in a research project on echinococcosis in the archipelago of Svalbard, *E. multilocularis* was detected in 16% of 172 sibling voles tested. In a follow-up study, the parasite was diagnosed in samples from polar foxes and one dog. Of the voles tested in 2000-2006, between 19% and 96% were positive each year.

# Toxoplasmosis

## *General evaluation of the national situation*

### History of the disease and/or infection in the country

In 1994, the last year human toxoplasmosis was notifiable, 33 cases were reported (incidence rate 0.77 per 100 000 inhabitants) of which eight were children less than one year. *Toxoplasma gondii* is endemic in animals in Norway with the domestic cat and wild lynx being the final hosts. Studies indicate that the parasite is relatively common among sheep; 18% of the lambs were seropositive in a survey conducted during the 1990s, and seropositive lambs were identified on 44% of the farms included. The parasite is assumed to be less common among Norwegian pigs. In the above mentioned survey, 2% of the slaughtering pigs tested were seropositive. In 2008, a survey using goat sera collected in the period 2002-2008 were tested. A total of 18.5% of the animals were positive. Also wild ruminants (cervids) can be infected; a survey carried out among 4300 cervids killed during hunting in 1992-2000, revealed 34% seropositive roe deer, 13% seropositive moose, 8% seropositive red deer and 1% seropositive reindeer.

### National evaluation of the recent situation, the trends and sources of infection

*Toxoplasma gondii* is endemic in Norway with the domestic cat and wild lynx being the final hosts. Studies indicate that the parasite is relatively common among sheep and goat and less common among Norwegian pigs. Also wild ruminants (cervids) can be infected. There are no data indicating recent developments in the prevalence of the infection in various species.

### Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases

A case control study designed to identify risk factors for maternal toxoplasma infection during pregnancy showed that the following exposures were associated with an increased risk: Eating raw or undercooked minced meat, eating unwashed raw vegetables or fruits, eating raw or undercooked mutton, eating raw or undercooked pork, cleaning the cat litter box and washing the kitchen knife infrequently after preparing raw meat. This implies that Norwegian farm animals and food products of Norwegian origin may well be an important source of human toxoplasmosis.

## *Toxoplasmosis in humans*

### Reporting system in place for the human cases

Human cases are not reported to the Norwegian Surveillance System for Communicable Diseases (MSIS).

### Case definition

A clinically compatible case that is laboratory confirmed.

### Diagnostic/analytical methods used

Serology (antibody detection) and parasitological examination (identification of parasite in clinical specimens).

### Notification system in place

Since 1995, human toxoplasmosis has not been a notifiable disease in Norway.

### History of the disease and/or infection in the country

In different epidemiological surveys conducted in Norway, 7-27% of pregnant women tested have been seropositive. The percentages have been age dependent, with the proportion of seropositive individuals increasing with age, and have also varied with region and ethnicity. It is estimated that approximately 90% of fertile women are susceptible to the disease and that approximately two out of 1000 susceptible pregnant women are infected during pregnancy. In 1994, the last year human toxoplasmosis was notifiable, 33 cases were reported (incidence rate 0.77 per 100 000 inhabitants) of which eight were children less than one year.

### Results of the investigation

The disease is not notifiable.

### National evaluation of the recent situation, the trends and sources of infection

*Toxoplasma gondii* is endemic in Norway although the parasite is considered to be somewhat less prevalent as compared to countries more south in Europe. The public health importance of toxoplasmosis is its potential of causing severe disease in infants who are born to women infected during pregnancy, and its potential of causing severe disease in immunocompromised individuals, such as people with AIDS. Seroprevalence surveys among pregnant women indicate that infection with *Toxoplasma* is common in Norway. Pregnant women are advised how to avoid infection during pregnancy.

### Relevance as zoonotic disease

A case control study designed to identify risk factors for maternal toxoplasma infection during pregnancy showed that the following exposures were associated with an increased risk: Eating raw or undercooked minced meat, eating unwashed raw vegetables or fruits, eating raw or undercooked mutton, eating raw or undercooked pork, cleaning the cat litter box and washing the kitchen knife infrequently after preparing raw meat. This implies that Norwegian farm animals and food products of Norwegian origin may well be an important source of *Toxoplasma* for spread to humans.

## *Toxoplasma* in animals

### Monitoring system

Sampling of animals is performed in case of clinical suspicion and in connection to import/export. Surveys are occasionally performed.

### Frequency of the sampling

In cases of clinical suspicion or specific surveys.

### Case definition

An animal with a positive test result.

### Diagnostic/analytical methods used

Serology (direct agglutination test), pathology, molecular methods.

### Measures in case of the positive findings or single cases

Normally none.

### Notification system in place

Toxoplasmosis in animals has been a List C disease according to the Animal Diseases Act since 1965.

### Results of the investigation

In 2011, several animal species were investigated for *Toxoplasma* at the Norwegian Veterinary Institute. A total of 19 sheep, seven goats, three cattle, one horse, one dog, seven cats, three hares, one polar fox and one wild bird was investigated as part of clinical investigations. Three sheep, one cat, two hares and one wild bird were positive. In addition, 110 farmed foxes and six swine were investigated by serology due to export control. All these animals were negative.

### National evaluation of the recent situation, the trends and sources of infection

*Toxoplasma gondii* is endemic in Norway. There are no data indicating recent developments in the prevalence of the infection in various species.

### Relevance of the findings in animals to findings in foodstuffs and to human cases

A risk for humans of contracting toxoplasmosis in Norway does exist. However, the relevance of clinical toxoplasmosis is most important in immunosuppressed persons and in pregnant women.

# Rabies

## *General evaluation of the national situation*

### History of the disease and/or infection in the country

Rabies in animals has not been recorded in mainland Norway. An epidemic occurred in the arctic fox population in the archipelago of Svalbard in 1980, with confirmed cases also in reindeer and one seal. Since then, sporadic cases occurred in arctic foxes, the last case in 1999. During the period 1980 - 2010, 25 animal cases were diagnosed. In 2011, an outbreak of rabies occurred in the Svalbard area in both reindeers and arctic foxes. However, transmission of rabies to humans has never been recorded in the archipelago of Svalbard.

### National evaluation of the recent situation, the trends and sources of infection

The favourable situation in mainland Norway regarding rabies has not changed. However, there are concerns about the risk of introducing rabies with illegally imported dogs from endemic countries. The reintroduction of rabies into the Svalbard area warrants intensified passive surveillance of the wildlife population. The general public in this area are informed through campaigns and mass vaccination has also been implemented.

### Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases

Rabies occur sporadically in wild animals in the archipelago of Svalbard. Although no transmission of rabies to humans has been recorded in Svalbard, people being in contact with wild animals in Svalbard should be aware of the risk and vaccination is recommended. In mainland Norway, the possible introduction of rabies with illegally imported animals is a concern.

## *Rabies in humans*

### Reporting system in place for the human cases

Human cases are reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), from microbiological laboratories as well as from clinical doctors. The system distinguishes between domestic and imported cases. The severity of the disease at the time of reporting is also recorded. However, the surveillance system does not follow individual patients over time to record further disease development and final outcome. Cases are also reported immediately to the Municipal Medical Officer. If a domestic animal source is suspected, the Municipal Medical Officer also informs the Norwegian Food Safety Authority. Investigations will be initiated in order to identify the source and prevent further cases.

### Case definition

A clinical case that is laboratory confirmed.

### Diagnostic/analytical methods used

Detection of viral antigens by an immunofluorescence test in neurological tissue (usually brain) in connection to post-mortem examination, virus isolation in cell culture, or identification of an antibody titre greater than the threshold value in serum or cerebrospinal fluid from an unvaccinated person.

### Notification system in place

According to the Communicable Disease Act, human cases are notifiable to the Norwegian Surveillance System for Communicable Diseases (MSIS) since 1975.

### History of the disease and/or infection in the country

Human rabies was last described in Norway in 1815.

### Results of the investigation

In 2011, no human cases were reported.

### Relevance as zoonotic disease

As mainland Norway has been free from rabies for almost two centuries and stringent regulation regarding import of animals are in place, the risk of contracting rabies in mainland Norway is close to zero. Rabies has sporadically been diagnosed in wild animals in the archipelago of Svalbard, and an outbreak affecting foxes and reindeer occurred in 2011. A mass vaccination campaign among the inhabitants of Svalbard was initiated because of this outbreak.. Although no transmission of rabies to humans has been recorded in Svalbard, the outbreak underlined that people being in contact with wild animals in Svalbard should be aware of the risk and vaccination of this group is recommended.

### Additional information

Rabies vaccine containing inactivated virus is available for the following indications: Pre-exposure prophylaxis to; 1) individuals with prolonged travels to countries with high incidence of rabies; 2) individuals who will work with animals in endemic areas; 3) persons who are at frequent risk of bites from bats; 4) laboratory personnel involved in rabies diagnostics. Post-exposure prophylaxis to individuals presumably exposed to rabies virus abroad or in the archipelago of Svalbard, or who have been bitten by bats. The post-exposure prophylaxis includes specific antiserum in addition to the vaccine.

### *Lyssavirus (rabies) in animals*

#### A. Rabies in dogs

##### Monitoring system

There is no active surveillance programme regarding rabies. However, being a notifiable disease, clinical suspicion of rabies must be reported immediately.

##### Frequency of the sampling

On clinical suspicion.

##### Type of specimen taken

Brain.

##### Methods of sampling (description of sampling techniques)

The brain is removed at autopsy, and samples are taken according to the procedures described in the OIE manual.

##### Case definition

A case that is laboratory confirmed.

##### Diagnostic/analytical methods used

The Fluorescent antibody test (FAT) is the OIE prescribed test for rabiesvirus antigen and is performed according to the OIE Terrestrial Manual 2010. In addition, molecular methods (real time RT-PCR, RT-PCR and gene sequencing) are used.

##### Vaccination policy

Vaccines containing inactivated rabies virus antigen are available for dog, cat and ferret. Vaccination is required for international transport of these animal species in compliance with national regulations. For dogs living in Svalbard vaccination is a mandatory requirement. Otherwise, vaccination against rabies is not done on a routine basis in mainland Norway.

##### Other preventive measures than vaccination in place

Infected animals will be destroyed and measures taken to prevent further cases.

##### Control program/mechanisms

Dogs, cats and ferrets entering Norway from countries not considered rabies free (include all third countries not listed in the annex "Listed third countries according to Regulation (EC) No 988/2003"), are subject to four months of quarantine in an officially approved station, followed by a two months period in home quarantine. However, dogs, cats and ferrets from EU and EEA countries are permitted into Norway without quarantine, provided they have been vaccinated against rabies. Dogs coming from Sweden do not need to be vaccinated.

##### Measures in case of the positive findings or single cases

Infected animals will be destroyed and measures taken to prevent further cases.

##### Notification system in place

Rabies has been a notifiable List A disease according to the Animal Diseases Act since 1965. Rabies is dealt with in Council Directive 92/65/EEC, which is implemented in Regulations on animal health conditions regarding movements, import and export of certain animals [FOR 2004-07-01 No 1105 and FOR 2004-02-20 No 464].

##### Results of the investigation

In 2011 no cases were reported. Five dogs from the Svalbard area were investigated and found negative.

### National evaluation of the recent situation, the trends and sources of infection

Mainland Norway is recognized as rabies free. However, there are concerns regarding a possible increase in the number of illegally imported dogs. Rabies was in 2011 found again among wild animals in the archipelago of Svalbard, the first time since 1999. Although no transmission of rabies to dogs has been recorded in Svalbard, owners must respect and follow up the mandatory vaccination programme.

### B. Rabies virus in wildlife

#### Monitoring system

There are no active surveillance programmes regarding rabies. However, the disease must be reported immediately on clinical suspicion.

#### Frequency of the sampling

On clinical suspicion. In Svalbard, dead foxes and other animals should be secured for laboratory examination.

#### Type of specimen taken

Brain, in bats also oral swabs.

#### Methods of sampling (description of sampling techniques)

The brain is removed at autopsy, and samples are taken according to the procedures described in the OIE manual.

#### Case definition

A case that is laboratory confirmed.

#### Diagnostic/analytical methods used

The Fluorescent antibody test (FAT) is the OIE prescribed test for rabiesvirus antigen and is performed according to the OIE terrestrial Manual 2010. In addition, molecular methods (real time RT\_PCR, RT-PCR and gene sequencing) are used.

#### Measures in case of the positive findings or single cases

Infected animals will be destroyed and measures taken to prevent further cases.

#### Notification system in place

Rabies has been a notifiable List A disease according to the Animal Diseases Act since 1965. Rabies is dealt with in Council Directive 92/65/EEC, which is implemented in Regulations on animal health conditions regarding movement, import and export of certain animals [FOR 2004-07-01 No 1105 and FOR 2004-02-20 No 464].

#### Results of the investigation

In 2011, one red fox from the mainland Norway was investigated and found negative. From the Svalbard area, one seal (*Erignathus barbatus*), four polar bears (*Ursus maritimus*), 19 reindeers and 140 arctic foxes (*Vulpes lagopus*) were investigated. Ten reindeers and five polar foxes were found positive.

### National evaluation of the recent situation, the trends and sources of infection

Mainland Norway is considered rabies free. Rabies was in 2011 found in wild animals in the archipelago of Svalbard, the first time since 1999. People in Svalbard are informed about the risk. There is a continuous passive surveillance in the Svalbard area.



## Q-fever

### *General evaluation of the national situation*

#### History of the disease and/or infection in the country

Q-fever has not been diagnosed in animals in Norway. In a survey in 2008, bulk milk samples from 460 dairy herds and 550 blood samples from 55 suckling cattle herds were sampled in six cattle dense counties (Rogaland, Sør-Trøndelag, Nord-Trøndelag, Hedmark, Oppland and Østfold). In surveys performed in 2009, samples from 349 goat herds (mainly bulk milk samples), samples from 121 sheep herds and 45 cattle herds were tested. In a survey in 2010, a total of 3289 herds (bulk milk samples) were tested. All samples were negative.

#### National evaluation of the recent situation, the trends and sources of infection

*C. burnetii* has never been detected in animals in Norway.

### *C. burnetii in animals*

#### Sampling strategy

Surveys are performed occasionally.

#### Case definition

Sample positive for antibodies against *C. burnetii*.

#### Diagnostic/analytical methods used

Detection of antibodies to *C. burnetii* in milk or serum by ELISA.

#### Results of the investigation

In 2011, a total of 22 cattle, 39 sheep (import control) , 13 goats (import control), three swine (from a breeding company - export control), one farmed deer (import control) and 115 alpacas (from 9 imported herds) were tested for Q-fever. All samples were negative.

## Information on specific indicators of antimicrobial resistance

### *Escherichia coli* and *Enterococcus spp.*, non-pathogenic

#### National evaluation of the recent situation, the trends and sources of infection

Data from the monitoring programme NORM-VET indicate a low to moderate prevalence of resistance in indicator *E. coli* and *Enterococcus* spp. from Norwegian food producing animals and food. Those resistances that are most commonly encountered are to antimicrobials that have been or still are typically used therapeutically. Fluoroquinolone resistance is rarely detected, which is a reflection of a very low use of such antimicrobials in food producing animals in Norway.

#### Sampling strategy used in monitoring

The sampling of animals for isolation of indicator bacteria to be included in resistance monitoring is a part of the Norwegian monitoring programme for antimicrobial resistance in feed, food and animals, NORM-VET. The sampling is spread throughout the year and each year one or several animal species are included.

#### Type of specimen taken

Faecal material.

#### Methods of sampling (description of sampling techniques)

The samples were taken as part of different surveillance programmes.

#### Procedures for the selection of isolates for antimicrobial testing

Only one isolate from each herd or flock was included.

#### Methods used for collecting data

Identification and antimicrobial susceptibility testing was performed at the Norwegian Veterinary Institute.

#### Laboratory methodology used for identification of the microbial isolates

*E. coli*: Sample material was plated directly onto the surface of lactose-bromthymol blue agar without broth enrichment and incubated at 37°C for 24 h. Typical colonies were plated onto blood agar (Heart infusion agar (Difco) containing 5% bovine blood) and incubated at 35-37°C for 24 h. Colonies were identified as *E. coli* by typical appearance, lactose fermentation, a positive indole reaction and negative citrate and oxidase reactions.

*Enterococcus* spp.: Sample material was plated onto the surface of Slanetz & Bartley agar (Oxoid) with 32 mg/L vancomycin and incubated at 44°C for 48 h. Colonies from each positive sample were selected, and the isolates confirmed as *Enterococcus* spp. by phenotypic characterization. The isolates were further identified to the species level and tested for the presence of the *vanA* gene using PCR (Dutka-Malen et al., 1995, Simonsen et al 2000).

#### Laboratory methods used for detection for resistance

The VetMIC microdilution method (Dept. of Antibiotics, National Veterinary Institute, Sweden) was used for the susceptibility testing of all isolates. The antimicrobials included are listed in the table.

#### Cut-off values used in testing

For interpretation of results epidemiological cut-off values recommended by EFSA were applied. When no cut-off value was recommended, a cut-off value was defined on basis of the actual MIC distributions obtained in the NORM-VET programme.

#### Control program/mechanisms

The sampling of animals for isolation of indicator *E. coli* to be included in resistance monitoring is a part of the Norwegian monitoring programme for antimicrobial resistance in feed, food and animals, NORM-VET.

#### Results

The qualitative data are presented in the table. Quantitative data as well as data on breakpoints and range of testing are presented in the NORM/NORM-VET 2011 report.

Table Antimicrobial susceptibility testing of *E. coli* from pigs and broilers.

	Pigs	Broilers
<b>Number of isolates tested</b>	192	206
<b>Percentage of isolates resistant to</b>		
Tetracycline	9.4	4.4
Chloramphenicol	0.5	0.5
Cefotaxime	0.5	0.0
Nalidixic acid	0.0	1.9
Sulfamethoxazole	10.4	9.2
Trimethoprim	7.3	0
Streptomycin	17.2	4.9
Gentamicin	0	0
Ampicillin	7.8	14.6

Table Antimicrobial susceptibility testing of *Enterococcus* spp. from broilers

	<i>E. faecalis</i>	<i>E. faecium</i>
<b>Number of isolates tested</b>	62	176
<b>Percentage of isolates resistant to</b>		
Tetracycline	45.2	11.4
Chloramphenicol	11.3	0
Streptomycin	17.7	0.6
Gentamicin	0	0
Erythromycin	25.8	5.7
Vancomycin	0	0
Ampicillin	0	0.6

## Information on specific microbiological agents

### *Histamine in foodstuffs*

#### Monitoring system

Regular testing of selected species is required as an internal part of food business operator's quality assurance system. Surveys are performed occasionally.

#### Definition of positive finding

Histamine values above 100 mg/kg.

#### Diagnostic/analytical methods used

Reverse phase HPLC/UV

Table Histamine in foodstuffs

	Source of information	Sampling unit	Sample weight	Units tested	Total units in non-conformity	<=100 mg/kg	>100 - <=200 mg/kg	>200 - <=400 mg/kg	>400 mg/kg
Fishery products from species associated with a high amount of histidine	NIFES	single	5 g	30	1	29	1		
Fish – farmed - salmon	NIFES	single	5 g	15	0	15*			

\* All samples <5.5 mg/kg

## Foodborne outbreaks

Foodborne outbreaks are incidences of two or more human cases of the same disease or infection where the cases are linked or are probably linked to the same food source. Situation, in which the observed human cases exceed the expected number of cases and where a same food source is suspected, is also indicative of a foodborne outbreak.

### System in place for identification, epidemiological investigations and reporting of foodborne outbreaks

Health personnel are required to report suspected foodborne outbreaks to the Municipal Health Officer, who is required to report to the County Governor (Fylkesmannen) and to the Norwegian Institute of Public Health. Suspected outbreaks are reported immediately to the Municipal Medical Officer who notifies the Norwegian Institute of Public Health the same day. If a domestic food or animal source is suspected, the Municipal Medical Officer also informs the local Food Safety Authority.

The Norwegian Food Safety Authority has voluntary reporting where the District Offices report foodborne outbreaks.

Norway has since 2005 a web-based reporting system called Vesuv where all outbreaks in humans are to be reported and stored in a database at the Norwegian Institute of Public Health. Vesuv came in a new version in 2010.

If an indigenous outbreak is suspected, epidemiological investigations will be initiated in order to identify the source and prevent further cases. For imported cases, the country of acquisition will be recorded. If information through international networks indicates that a case belongs to an outbreak, epidemiological investigations will be initiated.

### Description of the types of outbreaks covered by the reporting

All suspected foodborne outbreaks are notifiable. The definition of a foodborne outbreak is two or more human cases with the same infection where the cases are linked or are probably linked to the same food source, or when observed number of human cases exceeds the expected number of cases during the same time period and place, and food is a likely vehicle.

### Trends in numbers of outbreaks and numbers of human cases involved

The number of reported foodborne outbreaks increased in Norway the first years after the web-based reporting system was established in 2005 (42 in 2005, 65 in 2006 and 80 in 2007). We believe that this increasing trend was due to a higher reporting frequency rather than a real higher number of outbreaks. The number of reported outbreaks decreased again in 2008 (64), 2009 (47) and was stable in 2010 (53) and 2011 (51).

### Relevance of the different causative agents, food categories and the agent/food category combinations

Traditionally, the most common cause of foodborne outbreaks in Norway has been bacterial intoxication (*Clostridium perfringens*, *Bacillus cereus* and *Staphylococcus aureus*). Recently, foodborne outbreaks of norovirus caused by infected food handlers and imported food items have become more common. Reported domestic outbreaks of salmonellosis and campylobacteriosis have been relatively rare.

### Relevance of the different type of places of food production and preparation in outbreaks

Traditionally, outbreaks have mainly been associated with inadequate handling and temperature abuse, causing food intoxication. In addition, untreated water has caused several outbreaks.

### Evaluation of the severity and clinical picture of the human cases

In 2011, no severe outbreak was reported. No deaths were related to foodborne outbreaks.

### Descriptions of single outbreaks of special interest

The same strain of *Yersinia enterocolitica* O:9 was isolated in samples from 21 cases during the period from April to September. Epidemiological studies showed that the outbreak was associated with consumption of ready-to-eat salad products, an unusual vehicle for this pathogen.

Table  
Reported foodborne outbreaks in Norway 2011 - summarized data

Agent	Total number of outbreaks (verified outbreaks)	Human cases	Implicated food in verified outbreaks
Foodborne viruses	15 (1)	405	Raw oyster
<i>Campylobacter</i> spp.	5	60	
<i>Shigella sonnei</i>	3 (2)	82	Fresh basil, buffet meal
<i>Clostridium perfringens</i>	3	90	
<i>Staphylococcus aureus</i>	2 (1)	12	Soft ice
<i>Salmonella</i> spp.	1	3	
<i>Yersinia enterocolitica</i>	1 (1)	21	Ready-to-eat salad products
Other agents <sup>1</sup>	7	59	
Unknown	14	120	

<sup>1</sup> *Francisella tularensis* (2) , *Bacillus cereus*, *Vibrio parahaemolyticus*, Hepatitis A virus, Histamine, Wax ester from Escolar.