

The Norwegian Zoonoses Report 2016



Veterinærinstituttet
Norwegian Veterinary Institute

The Norwegian Zoonoses Report 2016

Content

Summary	2
Introduction	2
Origin of data	2
Preventive and protective measures	3
Acknowledgements	4
Salmonellosis	5
Campylobacteriosis	7
Yersiniosis	9
Listeriosis	10
<i>E. coli</i> (VTEC)	11
Tuberculosis	12
Brucellosis	13
Trichinellosis	14
Echinococcosis	15
Toxoplasmosis	16
Rabies	17
Q-fever	18
BSE and vCJS	19
Antimicrobial resistance	20
Foodborne outbreaks	21
Appendix Tables 2016	22

Authors

Hannah J. Jørgensen¹, Berit Heier¹, Kjell Hauge²
(Norwegian Food Safety Authority), Heidi Lange³
Bernardo Guzmán Herrador³, Solveig Jore³,
Merete Hofshagen¹

¹) Norwegian Veterinary Institute

²) Food Control Authorities

³) Norwegian Institute of Public Health

ISSN 1890-3290

© Norwegian Veterinary Institute 2016

In collaboration with



Design Cover: Reine Linjer

Photo front page: Colourbox

Summary

Overall the situation in 2016 was favourable with respect to zoonoses in Norway. It is a concern, however, that the fraction of *Campylobacter*-positive poultry flocks increased to almost 8% in 2016. In previous years, between 3% and 6% of the tested flocks were positive for *Campylobacter*. It was also noteworthy that a few farms delivered the majority of *Campylobacter*-positive flocks in 2016.

Meticillin resistant *Staphylococcus aureus* (MRSA) was detected, for the first time in Norway, in a milk sample from a dairy cow. The bacteria were most likely introduced to the cow herd from humans, which emphasises the role of humans as a reservoir of resistant bacteria to animals. If these bacteria become established in the animal population they may in turn transmit back to humans. Globalisation and increased travel among humans increases the likelihood of introducing resistant bacteria to Norwegian animals.

In humans the situation with respect to zoonoses was also favourable; the exception was *E. coli* (VTEC) for which the number of cases continued to rise. The increase observed in the last years can, in part, be explained by altered diagnostics, but the development is concerning because the infection can cause serious disease.

Introduction

The Zoonosis report is published annually in Norway in accordance with the requirements of the EU Council Directive 2003/99/EC. In addition, data on specified zoonoses in feed, animals and food are reported to the European Food Safety Authority (EFSA). Corresponding data from humans are reported to the European Center for Disease Control (ECDC). These two European institutions compile an annual European zoonosis report based on the received data:

(http://www.efsa.europa.eu/en/publications/advanced-search/?sub_subject=61616).

The Norwegian Veterinary Institute (NVI) is responsible for reporting of Norwegian data to EFSA, while the Norwegian Institute of Public Health (NIPH) reports Norwegian data to ECDC. The zoonosis report is written by the NVI in collaboration with the Food Safety Authorities and NIPH.

Origin of data

Humans

“The Norwegian Surveillance System for Communicable Diseases” (MSIS) was implemented nationally in Norway in 1975, and the NIPH is responsible for managing the system. The main purpose of MSIS is surveillance to reveal trends and outbreaks of communicable diseases.

According to the Infectious Disease Control Act, all laboratories that analyse samples from humans, and all physicians, must report to the NIPH all cases of specified communicable diseases (at present 65 different diseases). All zoonoses described in this report, with the exception of toxoplasmosis, are notifiable.

Patients who have not travelled abroad during the incubation period for the infection they are diagnosed with are classified as infected in Norway. Patients who develop disease abroad or shortly after returning home to Norway are classified as infected abroad. Patients, for whom information regarding travel is not available, are classified as «unknown origin» with respect to where the infection was contracted.

The District Medical Officer must notify the Food Safety Authorities in cases where humans are believed to be infected from animals or food.

Feed, animals and food

Data that are presented in the Zoonosis report, which are also reported to EFSA, stem from national surveillance programmes, projects, diagnostic investigations and various controls and inspections performed by Authorities and private companies. Two types of data are reported:

- Data on notifiable diseases (reported to the Food Safety Authorities) and from public surveillance. Together, these data provide an overview of the Norwegian situation and any changes in it. The Food Safety Authorities decide which surveillance programmes that are carried out and which infections are notifiable. The NVI assists with planning and practical work (e.g. laboratory analyses), and also contribute with data processing and reporting. Testing of animals and food for various zoonotic agents are also performed in association with import or export. In addition, surveillance is carried out by the Food Safety Authorities through pre-and post-mortem inspections in association with commercial slaughter.
- Data from diagnostic investigations and data from internal control systems of food-, and feed-producing companies are also included in the zoonosis report. All laboratories have an obligation to report, to the Food Safety Authorities, any detection of notifiable diseases in animals. A large proportion of the laboratory diagnostics (including pathology) performed on animals in Norway is performed by the NVI. However, other laboratories than the NVI may also be used for diagnostic investigations, and therefore the reported data from diagnostic work are not complete. This is especially relevant for laboratory diagnostics of companion animals, because samples from these animals are often sent to laboratories abroad. Data from internal control of companies are not always available either. One exception is Salmonella control in feed producing companies where data from most of the performed internal control is made available and is reported herein.

Notifiable diseases/agents in animal and humans are presented in Table 1.

Preventive and protective measures

Norway has quite strict regulations to prevent introduction and spread of certain infections in animals and humans.

Humans

When notifiable zoonoses are detected in humans, investigations are performed to trace the source of infection and measures to prevent new cases are implemented. In cases where food or animals are suspected to be the source, the Food Safety Authorities are notified.

Patients with communicable infections that may transmit through food and who work in the food industry (with a risk of contaminating food) should not work while they have symptoms and should have three (five for EHEC/VTEC) negative faecal samples after clinical improvement before resuming work.

Feed, animals and food

According to the Food act (Matloven), companies and others are responsible for exercising attention and care to prevent development or spread of contagious disease in animals, and further to notify the Food Safety Authorities about any suspicion of a contagious disease in animals that has potential to cause substantial negative consequences for society.

The Regulation on Notification of Diseases in animals determines that veterinarians and laboratories must notify the Food Safety Authority about listed animal diseases categorized as A-, B-, and C-diseases. In addition there is a general duty to notify diseases in animals that:

- could cause death or serious disease in humans.
- could result in high numbers of animals becoming diseased or exposed to infection.
- could result in substantial economic losses for society.
- could cause other substantial consequences for society.
- are presumed not to exist in Norway or have an unexpected distribution
- compromises animal health in an unexpected manner or in an unexpected fashion.

If a group A- or B-disease is detected in animals in Norway, restrictions will be imposed on the infected animal or animal holding, and attempts will be made to eradicate the infective agent. The imposed/recommended measures depend on animal species, management system, and the infective agent. In cases where a zoonosis is detected or suspected, the Food Safety Authorities must notify the District Medical Officer if the infection has transmitted- or may transmit to humans.

Companies that produce or sell food are themselves responsible for ensuring that the products they produce or sell are safe to consume. The Food Safety Authority follows up and inspects the food industry to ensure that they exercise their responsibility. Food producers must also consider zoonoses in their internal control systems. In addition to the national surveillance programmes and various short term projects initiated by the central office of the Food Safety Authority, the regional offices of the Food Safety Authority perform some sampling. However, these latter data are not included in the report.

In total, 15 border control stations and associated border control centres (7) in Norway perform control of foods and foodstuffs of animal origin that are imported from non EU and non-EEA-countries.

If a zoonotic agent is detected in a food or foodstuff, measures are carried out to prevent spread and to identify the source. The District Medical Officer must be notified, and if there is a risk that animals have been infected or may become infected, the Food Safety Authority must perform further investigations.

Table 1. Disease/agents included in the zoonosis report in 2016 and their status with respect to notifiability and existing surveillance programmes.

Disease/agent	Notifiability			Feed, animals and food
	Humans	Feed and food	Animals	Surveillance programme
Salmonellosis	Yes	Yes	Yes (B-disease)	Yes
Campylobacteriosis	Yes	No*	No**	Yes
Yersiniosis	Yes	No*	No	No
Listeriosis	Yes	No*	Yes (C-disease)	No
Pathogenic <i>E. coli</i>	Yes	Yes*	Yes*	Yes (not annually)
Tuberculosis	Yes	Yes	Yes (B-disease)	Yes
Brucellosis	Yes	Yes	Yes (A-disease)	Yes
Trichinellosis	Yes	Yes	Yes (B-disease)	Yes
Echinococcosis	Yes	Yes	Yes (B-disease)	Yes
Toxoplasmosis	No	No	Yes (C-disease)	No
Rabies	Yes	-	Yes (A-disease)	No
Q-fever	Yes	-	Yes (C-disease)	No
BSE og vCJD	Yes	-	Yes (B-disease)	Yes

* Some conditions are notifiable according to national regulation within specific areas. Otherwise the food law contains a general obligation to immediately inform the competent authorities if there exists a risk or potential risk (to human, animal and plant health) of significant consequences to the society.

** The exception is broiler chickens during the summer season, because these are included in the surveillance programme, and measures are implemented if samples are positive.

Acknowledgements

NIFES, Geno, Norsvin and the feed industry are gratefully acknowledged for contributing with data for this report.

Salmonellosis

The infection - symptoms and transmission

There are more than two thousand variants of *Salmonella* bacteria. The most common symptom of *Salmonella* infection is diarrhoea, both in humans and in animals, but healthy carriage is not uncommon. *Salmonella* are shed in faeces and the most important source of infection is contaminated food, feed or water. It can also spread through direct contact with infected individuals.

Surveillance and control

Salmonellosis in humans is notifiable in Norway. Infection in animals is listed as a group B-disease. Detection of *Salmonella* in feed or food must be reported to the Food Safety Authority.

Surveillance of *Salmonella* in feed, cattle, swine and poultry (live animals and animal products) started in 1995. Testing is performed in cases of disease, in relation to live animal import and as part of *Salmonella* control systems in feed production. Vaccination of animals against *Salmonella* is forbidden in Norway.

Results 2016

The number of reported cases of salmonellosis in humans (865) is the lowest in 20 years (Figure 1). Information on the detected serotypes is presented in the Appendix.

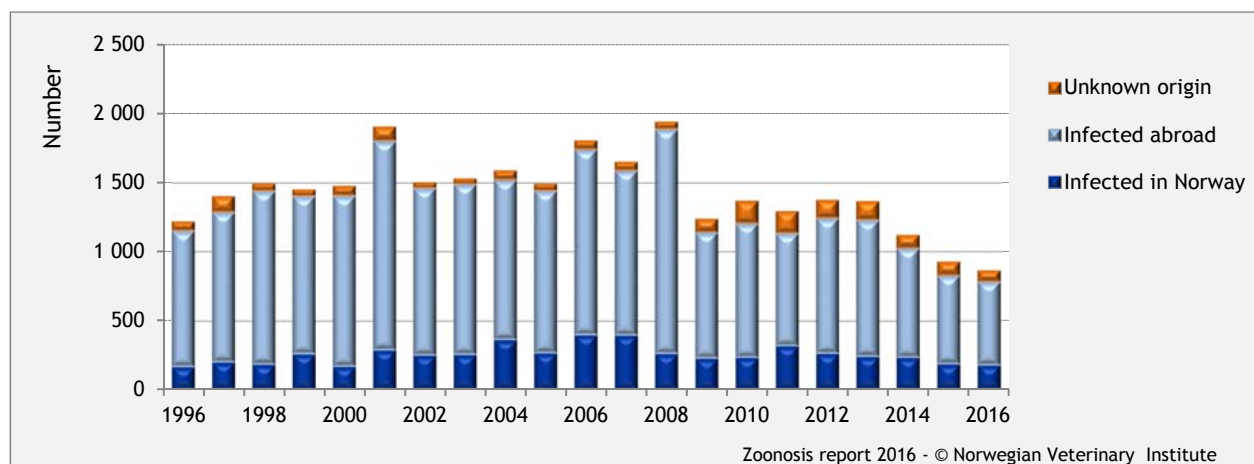


Figure 1. Reported cases of salmonellosis in humans. Data from MSIS.

Two *Salmonella* positive broiler flocks and a positive layer flock were detected in the surveillance programme. *Salmonella* was also detected in a lymph node from one swine. In addition, a few cases of salmonellosis were diagnosed in animals with disease. Details on *Salmonella* testing of feed, animals and food are shown in the Appendix.

Evaluation of the current situation

A reduction in the number of salmonellosis cases in humans has been evident in the last few years. More than 70% of the infected humans are believed to have contracted the infection abroad. The reduced prevalence of *Salmonella* in European poultry is presumed to contribute to the observed reduction. Data from outbreaks of salmonellosis indicate that a great variety of foods can be implicated. When infection is contracted in Norway, imported foods are more often implicated than foods produced in Norway.

In Norway, food producing animals are very rarely infected with *Salmonella*. This is well documented in the surveillance program. *Salmonella diarizonae* is occasionally detected in Norwegian sheep. This *Salmonella* variant, is only rarely associated with disease in animals, and is not considered a public health threat either. However, carcasses from which *S. diarizonae* is detected are not used for human consumption.

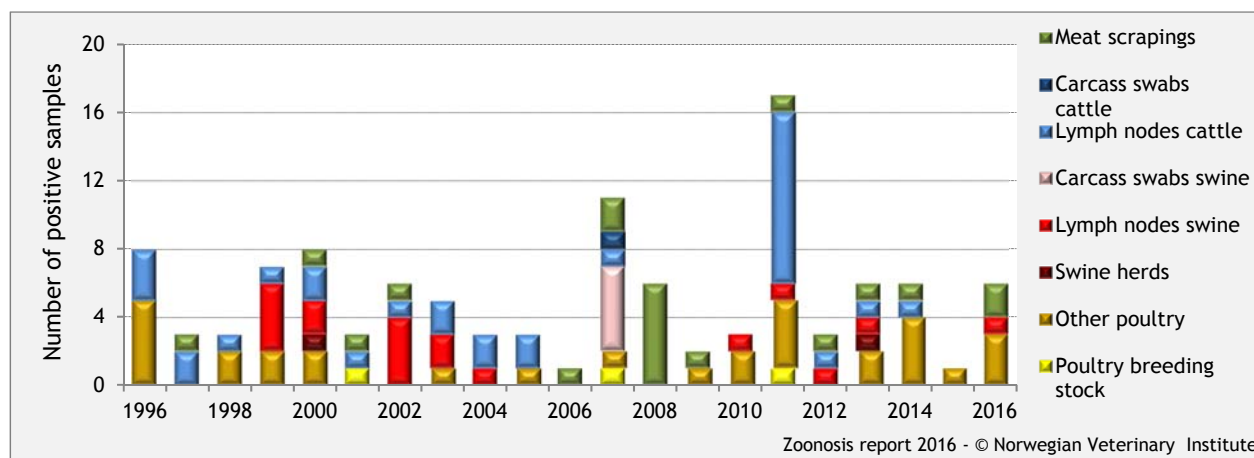


Figure 2. The number of positive samples in the *Salmonella* surveillance programme.

Salmonella is occasionally detected in dogs and cats and in reptiles in Norway. Infected pets may constitute a risk of infection for humans. *Salmonella* Typhimurium can sometimes be detected from wild birds and hedgehogs in Norway. Contamination of food and water by these animals may lead to infection of humans.

Feed given to domestic animals in Norway is basically free from *Salmonella*, but *Salmonella* is sometimes detected in feed factories, especially those producing fish feed.

Continued surveillance of *Salmonella* in animals, feed and food is necessary for early detection, to facilitate control and to sustain the beneficial situation with respect to *Salmonella* in Norway.

Campylobacteriosis

The infection - symptoms and transmission

There are many *Campylobacter* variants, but *C. jejuni* and *C. coli* are the most important zoonoses. These are commonly found in the guts of healthy birds, and humans may contract the infection through contaminated food or water or by direct contact. Diarrhoea is the most common symptom of Campylobacteriosis, but more severe disease may also occur.

Surveillance and control

Campylobacteriosis is notifiable in humans in Norway, but not in animals (except *C. fetus* in cattle). In humans, only campylobacter infections verified by culture are registered in MSIS.

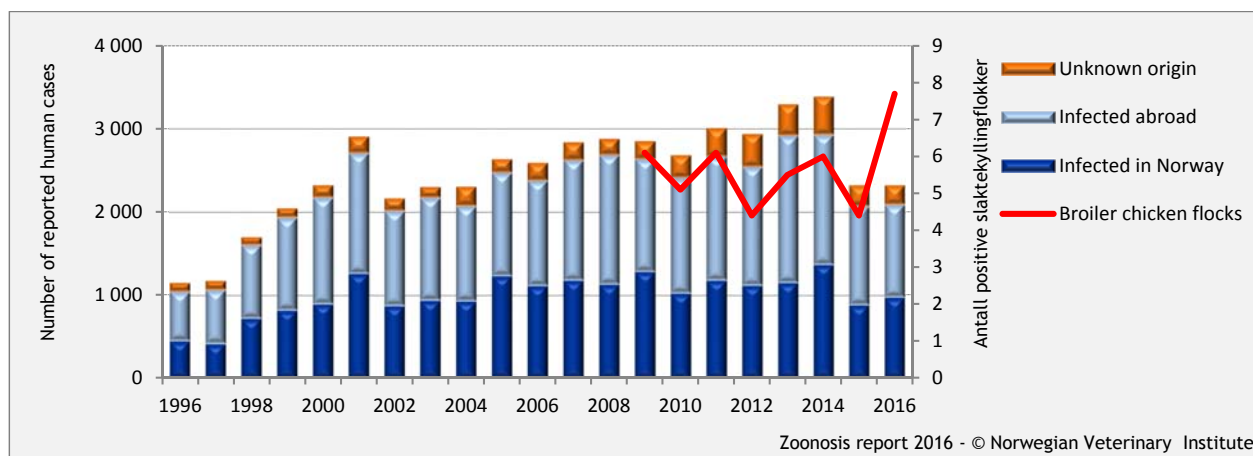
Norway has a surveillance program for *Campylobacter* in broiler chickens. All flocks slaughtered between the 1st May and 31st October must be tested prior to slaughter. Carcasses from positive flocks must be heated or frozen prior to sale in order to reduce the potential for transmission to humans. Pasteurisation of milk and disinfection of water are other measures that prevent transmission of *Campylobacter* to humans.

Results 2016

In MSIS, 2317 culture-positive human cases were reported, and 970 of these contracted the infection in Norway. In addition, 1209 cases were positive for *Campylobacter* by PCR, and of these 471 were infected in Norway, 567 contracted the infection abroad and for 171 of the cases the infection had unknown origin. The cases verified by PCR only are not notifiable to MSIS, which may explain the apparent reduction in number of cases in 2015. Altogether, the number of positive cases in humans (verified by culturing + verified by PCR) for 2016 was similar to recent years.

An increase in the number of positive broiler flocks was observed in 2016 (175 positive flocks between 1st May and 31st October). Although the number of positive flocks was not much higher than in 2015, the fraction of positive flocks increased (7.7 % in 2016 compared to 4.4% in 2015). In total, 22.2% of the farms delivered at least one *Campylobacter*-positive broiler flock. And 7.9% of the farms delivered at least two positive flocks.

In the diagnostic services at the Norwegian Veterinary Institute, *Campylobacter* was detected in samples from 31 cattle, three sheep, seven pigs, 66 dogs and three cats. For details see the Appendix.



Figur 3. The number of reported cases of campylobacteriosis in humans (data from MSIS) and the % of positive broiler flocks (sampled between 1st May and 31st October) from 2009. From 2015 *Campylobacter* in humans was also diagnosed by PCR in some laboratories, but these results are not registered in MSIS.

Evaluation of the current situation

Campylobacteriosis is the most commonly reported zoonosis in Norwegian humans. More than half of the reported cases are presumed to have been infected abroad. Annually, about 1000 persons contract the infection in Norway.

Case-control studies have shown that the most common source of campylobacteriosis in Norway is the use of untreated water at home, in holiday homes or in nature. Eating or preparing poultry and barbeque meals are also identified as risk-factors for infection. No studies have demonstrated a link between eating beef or lamb despite a considerable prevalence of *Campylobacter* in these animals in Norway. However, one study showed that eating inadequately heat treated pork was associated with an increased risk of *Campylobacter* infection. Studies have also shown that direct contact with domestic animals (cattle, sheep, poultry, dogs and cats) is associated with an increased risk of campylobacteriosis in humans.

The prevalence of *Campylobacter* in broilers has been low in Norway (3-6 % of slaughtered flocks) for the last years compared to other countries. The measures implemented in Norway, to reduce *Campylobacter* in chicken meat, are presumed to have had a positive effect on public health. It is, therefore, concerning that the percentage of positive broiled flocks increased to almost 8% in 2016.

Yersiniosis

The infection - symptoms and transmission

Certain serogroups of the bacteria *Yersinia enterocolitica* can cause disease in humans, and the most common symptom is diarrhoea. Swine are considered the main source of these disease-causing variants, and the most common sources of human infection are contaminated food or water.

Yersinia paratuberculosis is a different bacterium that may cause disease in humans and animals.

Surveillance and control

Yersiniosis in humans is notifiable, while detection of *Y. enterocolitica* in animals is not. There is no surveillance for this bacterium in animals or food in Norway. Because healthy swine can be carriers, contamination of carcasses may occur at slaughter. Good hygiene at slaughter reduces this risk.

Results 2016

The number of reported cases of yersiniosis (57) was similar to previous years (Figure 4)

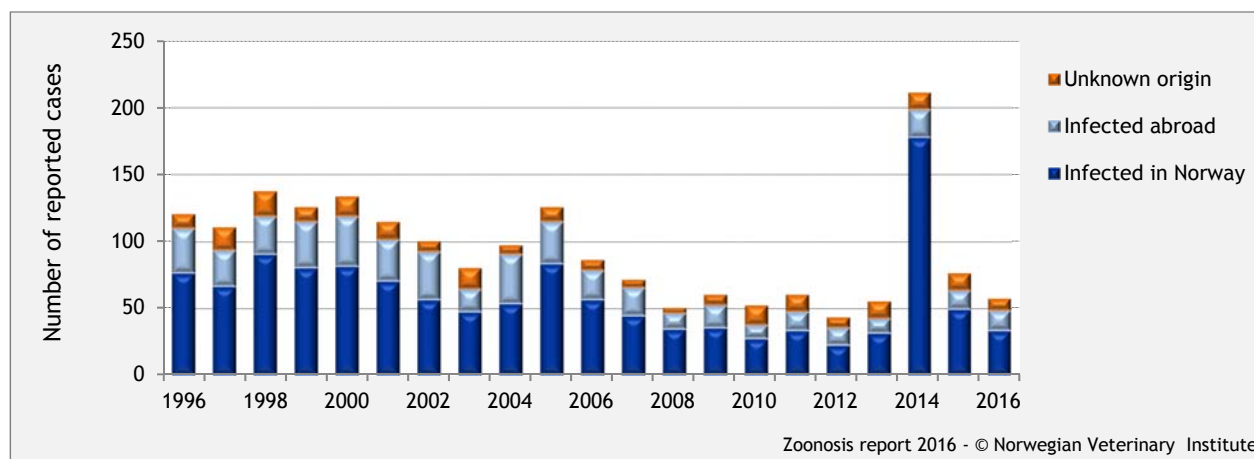


Figure 4. The number of reported cases of yersiniosis in humans. Data from MSIS.

In the diagnostic services at the Norwegian Veterinary Institute, *Y. enterocolitica* was detected in a sample from one dog, and *Y. pseudotuberculosis* was detected in one hare and one goat.

Evaluation of the current situation

Most yersiniosis cases in humans in Norway are sporadic and most have been infected domestically. In 2014, there was a significant increase in the number of reported cases due to an outbreak in a military camp.

Yersinia enterocolitica is presumed to be prevalent in swine and the bacteria cannot be eliminated from swine flocks. During the 1990s routines for improved slaughter hygiene were implemented and this has contributed to reducing the number of human cases of yersiniosis.

Listeriosis

The infection - symptoms and transmission

Listeria monocytogenes occurs naturally in the environment and is mainly pathogenic for pregnant women, the elderly and people with a compromised immune system. Occasionally babies may be born with listeriosis. The infection can cause fever, abortion, meningitis and septicaemia. The main route of infection is contaminated food or water. In animals, listeriosis causes central nervous disease (meningitis), and abortion. Feed is the main source of infection in animals.

Surveillance and control

Listeriosis in humans is notifiable. In animals it is categorised as a group C-disease. Detection of *L. monocytogenes* in animals usually does not result in any measures. Detection of *L. monocytogenes* is included as part of the control system in the manufacture of certain food products.

The upper limit for *L. monocytogenes* in ready-to-eat foods is 100 cfu/g and 0 cfu/ml in products intended for small children or persons with certain medical conditions. If the upper limit is exceeded, the food must be withdrawn from market and measures must be implemented to avoid further contamination. Dietary advice is available for persons in risk groups www.matportalen.no and www.fhi.no

Results 2016

Twenty cases of listeriosis were reported in humans in 2016 (Figure5.).

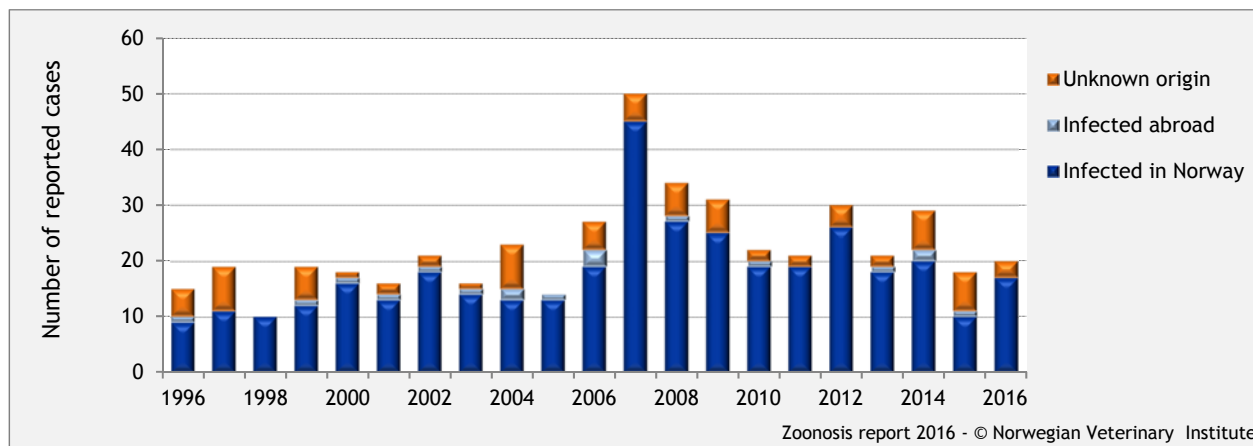


Figure 5. The number of cases of listeriosis in humans. Data from MSIS.

The National Institute of Nutrition and Seafood Research (NIFES) examined 198 samples of seafood for *L. monocytogenes* and 5 samples were positive, but had less than 100 cfu/g. The Norwegian Food Safety Authority collected 250 samples from food and production facilities, and five of these were positive. At the Norwegian Veterinary Institute, *L. monocytogenes* was detected in diagnostic samples from six sheep, two goats, two cows, one llama and one roe deer.

Evaluation of the current situation

There are few reports of listeriosis in both humans and animals in Norway, but the infection can have severe consequences. Therefore, it is important that manufacturers of ready-to-eat foods have proper routines for preventing *Listeria* in their products, and systems for traceability and withdrawal of products from the market in case *L. monocytogenes* should be detected. Farmers, especially sheep farmers, must ensure that feed is of good quality to reduce the risk of listeriosis in animals.

E. coli (VTEC)

The infection - symptoms and transmission

Escherichia coli are normal inhabitants of the intestines of humans and animals. Some variants of these bacteria may produce verotoxins (also called shigatoxin). The toxin-producing *E. coli* variants are called VTEC or STEC, and can cause serious disease and bloody diarrhoea in humans (hence the term EHEC - enterohaemorrhagic *E. coli*). Transmission occurs via food or water or by direct contact.

Surveillance and control

EHEC and diarrhoea-associated haemolytic uremic syndrome (HUS) are notifiable in humans. Detection of VTEC/STEC in animals is not notifiable but the Norwegian Food Safety Authority should be informed so that measures can be considered. There is no routine surveillance of VTEC/STEC in animals or food, but several screening studies have been performed.

VTEC/STEC should not be found in ready-to-eat foods and detection of these bacteria in such foods would lead to withdrawal of the product from the market. Good hygiene and proper routines at slaughter reduces the risk of contamination of meat with VTEC/STEC.

Results 2016

The number of reports in humans (239) is the highest since the infection became notifiable (Figure 6.).

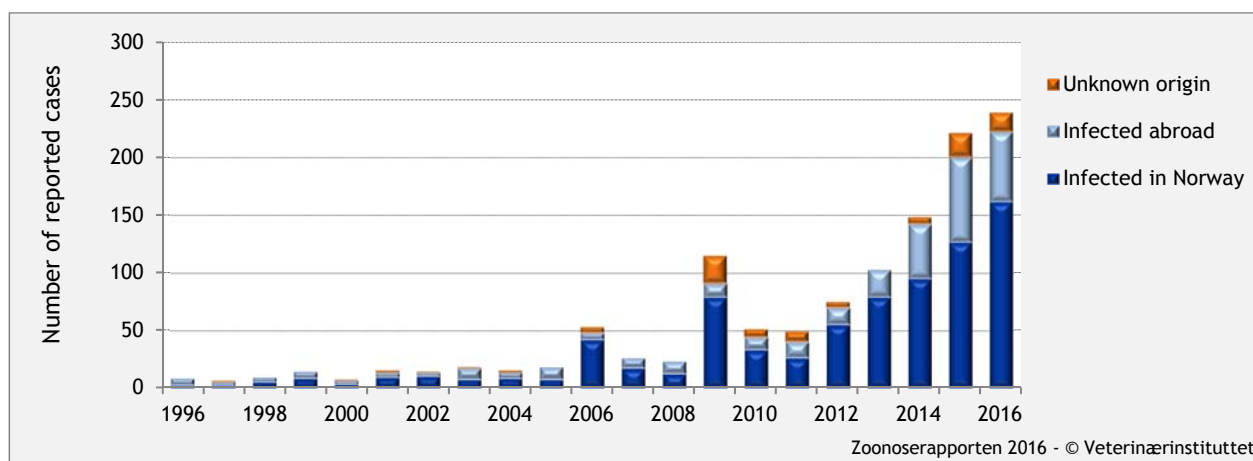


Figure 6. The number of reported cases of EHEC (enterohaemorrhagic *E. coli*) in humans. Data from MSIS.

In connection with four cases of EHEC-associated disease in humans, a total of 16 samples, mostly from animals, were analysed at the Norwegian Veterinary Institute. Disease associated bacterial isolates of VTEC, were not detected.

Evaluation of the current situation

The occurrence of EHEC-infections in humans is increasing. More than half the cases have been infected in Norway. However, some of the increase is likely to be associated with the fact that some large laboratories have started using PCR to detect several different pathogens in all samples from patients with diarrhoea. Many different variants of VTEC may occur in animals. It is important, therefore, to follow up human disease cases with sampling of relevant food stuffs and possible contact with animals in order to gain knowledge on possible sources of infection.

Tuberculosis

The infection - symptoms and transmission

Tuberculosis is caused by Mycobacteria. As a zoonosis, *Mycobacterium tuberculosis* subsp. *bovis* (*M. bovis*), which causes bovine tuberculosis, is the most important. This bacterium is mostly found in cattle. Humans are usually infected by drinking unpasteurised milk. Tuberculosis in humans is usually caused by *M. tuberculosis* subsp. *tuberculosis* (*M. tuberculosis*) which is transmitted between humans in microscopic airborne droplets. Humans may also transmit tuberculosis to animals. Tuberculosis can cause an array of symptoms depending on the affected organ system, but symptoms from the respiratory system are most common. Tuberculosis is a chronic infection in both animals and humans.

Surveillance and control

Tuberculosis in humans is notifiable in Norway. Persons in higher-risk groups are offered BCG vaccination. Tuberculosis caused by *M. bovis* and *M. tuberculosis* in animals is categorised as a group B disease, while detection of other mycobacterial species are group C.

Norway is free of bovine tuberculosis, and this is acknowledged in the EEA agreement. Vaccination of animals against tuberculosis is forbidden in Norway. All animals, except poultry, are inspected for tuberculosis at commercial slaughter. Any suspicious findings will be examined further. Tuberculin testing is performed on all breeding bulls and breeding boars at semen collection facilities, imported animals, and in cases where tuberculosis is suspected or must be excluded. Animals with a positive tuberculin test will be euthanized and further examined. The Food Safety Authorities have a surveillance program for *M. tuberculosis* in cattle and deer.

Results 2016

In total, 298 cases of tuberculosis in humans were reported in 2016. Five of these were caused by *M. bovis*.

All cattle, sheep, goats, swine and horses commercially slaughtered in 2016 were examined *post mortem*. In addition, 195 breeding pigs and 158 breeding bulls were tuberculin tested. As part of diagnostic testing, samples from one sheep and 10 pigs were tested for Mycobacteria. All the samples were negative for tuberculosis/Mycobacteria. For details see the Appendix.

Evaluation of the current situation

With respect to *M. bovis* infection in humans, the situation in Norway is good. Less than 1% of the reported human tuberculosis cases in the last 5-10 years were caused by *M. bovis*, and these patients were either infected abroad or many decades ago (reactivated tuberculosis). The number of cases of tuberculosis caused by *M. tuberculosis*, however, has increased in Norway in the last 15 years due to immigration.

Bovine tuberculosis, *M. bovis* infection in cattle, was eradicated in Norway in 1963, but was detected in one area in the 1980s. This was most probably transmission from an infected human. Tuberculosis in animals caused by *M. tuberculosis* is rare in Norway and was last reported in a dog in 1989.

Import of live animals, especially camelids like llama and alpaca, to Norway is associated with a risk of introducing *M. bovis* to the Norwegian animal population. Foreign farm labourers could potentially also present a risk of introducing *M. bovis* and *M. tuberculosis* to Norwegian animals.

Brucellosis

The infection - symptoms and transmission

Brucellosis is caused by *Brucella* bacteria, of which *B. abortus* (cattle), *B. melitensis* (sheep), and *B. suis* (pigs) are the most important in a zoonotic perspective. *B. canis*, which causes disease in dogs, is less pathogenic in humans.

Brucellosis may cause sterility and abortion in animals. In humans, fever is the most common symptom. The bacteria are shed in milk, and humans are usually infected through consumption of unpasteurised milk and products made from unpasteurised milk.

Surveillance and control

Brucellosis in humans is notifiable and brucellosis in animals is listed as a group A-disease.

The surveillance program for *Brucella* includes blood tests from cattle that have aborted and annual blood testing of a proportion of the sheep and goat population. In addition, breeding bulls and boars and imported animals are tested. Vaccination of animals against brucellosis is forbidden in Norway. Norway is officially free of brucellosis according to the EEA agreement.

Results 2016

Four cases of brucellosis in humans were reported. Three of these were infected abroad and one was most likely infected through an imported cheese.

In the surveillance programme, 147 cattle from 62 herds, 9 821 sheep from 3 492 flocks, 2 312 goats from 86 herds were tested. All samples were negative. In addition, 1 944 swine, 232 cattle, five sheep, five camelides, and 16 dogs were tested. All samples were negative. For details see the Appendix.

Evaluation of the current situation

The situation in Norway, with respect to brucellosis is very good. In humans, it is rare with only 0-4 reported cases per year, most of which have been infected abroad. Some have been infected domestically from laboratory work or from eating products purchased abroad that were made from unpasteurised milk.

Bovine brucellosis was eradicated from Norway in 1953 and brucellosis in sheep, goats and pigs has never been detected in Norway. *B. canis* has been detected in Sweden, but not in Norway.

Trichinellosis

The disease and its transmission routes

Trichinellosis is caused small round worms, called *Trichinella*. Animals and humans may be infected through consumption of raw or poorly heat treated meat containing larvae. In the intestines the larvae grow into adult worms and reproduce. Adult females set free larvae that move away from the intestines to muscle tissue. The most common symptom of Trichinellosis is muscle pain, but the disease can also take more serious forms. Raw or poorly heat treated meat is the main source of infection.

Surveillance and control

Trichinellosis in humans is notifiable, and in animals it is a group B-disease. All carcasses of pigs and horses are checked for the presence of *Trichinella* at slaughter. Positive carcasses will be destroyed. Predator animals that are hunted/slaughtered and used for consumption (eg. wild boar or bear) should also be tested for *Trichinella*. It is forbidden in Norway to feed pigs with unsterilized food left-overs or to use carcasses from fur producing animals.

Results 2016

No cases of Trichinellosis were reported in humans.

All commercially slaughtered pigs and horses were tested for trichinosis. No animals were positive. For details see the Appendix.

Evaluation of the current situation

Trichinellosis in humans is very rare in Norway. The last case was reported in 1996, and the last case infected in Norway, was reported in 1980.

Trichinellosis in domestic animals in Norway was last reported in two pig herds in 1994, and before that the last report was in 1981. *Trichinella* may be found in wild animals, and the parasite may transmit to domestic animals kept outside such as swine and horses.

Echinococcosis

The disease and its transmission routes

Echinococcus granulosus and *E. multilocularis* are small tape worms that can cause serious disease in humans. The parasites have their adult stage in the intestines of predators (eg. fox and dog), and parasite eggs are shed in faeces of these hosts (definitive host). Other animals (intermediate host) are infected through ingestion of the eggs. In the intermediate host the eggs hatch to larvae that migrate and encapsulate in cysts in various organs. The intermediate host must be eaten by a final host for the parasite to develop further into adult stages. It is the larval cysts in the intermediate host, e.g. in humans, that cause disease. Humans may be infected through eating fruit and berries contaminated with eggs or through direct contact with infective definitive hosts (e.g. dogs).

Surveillance and control

Echinococcosis in humans is notifiable in Norway and in animals it is a group B disease. Intermediate hosts for *E. granulosus* (eg. reindeer and cattle), are examined at slaughter. Since 2006, hunted red foxes have also been examined for *E. multilocularis*. This surveillance was intensified in 2011 when the parasite was detected in Sweden.

Dogs imported to Norway from most countries must be treated against *Echinococcus* before arrival in Norway. Regular anti-parasitic treatment of dogs is also recommended in areas with reindeer.

Results 2016

Three cases of Echinococcosis in humans were reported, two had contracted the infection abroad and for one case it was unknown where the infection was contracted.

In the surveillance program for *E. multilocularis*, 575 foxes and eight wolves were examined, and all were negative. All commercially slaughtered cattle, sheep and pigs were examined for *Echinococcus post mortem*, and no cases were identified. For details see the Appendix.

Evaluation of the current situation

Echinococcosis has never been a public health problem in Norway. In humans between 0 and 5 cases are reported annually. So far all cases have been infected abroad.

E. granulosus was common in reindeer in northern Norway until the 1950s. Systematic treatment of shepherd dogs and reduced feeding of these dogs with raw meat and offal was effective and the parasite is now very rare in reindeer. It was last detected in 1990 and 2003. In cattle, *E. granulosus* was last reported in 1987.

E. multilocularis has never been detected in main-land Norway. However, it was recently detected in Sweden, and surveillance of red foxes is now intensified in Norway in order to rapidly detect the parasite should it be introduced to Norway. Since 2002, 5037 red foxes have been tested, and all were negative.

It is essential that dog owners follow regulations on antiparasitic therapy when traveling abroad with dogs or importing dogs. Echinococcosis occurs in dogs in southern Europe, and the infection may be introduced to the Norwegian dog population with untreated, imported dogs. *E. multilocularis* is endemic in Svalbard in sibling vole (*Microtus levis*) and the Arctic fox. Dogs in Svalbard are therefore at risk, and information about prevention must be provided to the population of Svalbard.

Toxoplasmosis

The disease and its transmission routes

Toxoplasma gondii is a single celled parasite that has its adult stage in the cat (definite host). The parasite is shed in faeces and intermediate hosts (e.g. sheep, human, rodents) are infected through contaminated food or water or by direct contact with contagious cats. Humans can also be infected through consumption of inadequately heat treated meat. Healthy adults will usually not become sick from toxoplasmosis. However, if women contract the infection for the first time during pregnancy, it may result in abortion or harm the foetus.

Surveillance and control

Toxoplasmosis is not notifiable in humans or animals in Norway.

The Food Safety Authority provides dietary advice to persons in risk groups (www.matportalen.no). Every year some animals are tested for *Toxoplasma gondii* due to disease, abortion or in association with import/export. Testing of cats for *T. gondii* is not considered necessary.

Results 2016

As part of the diagnostic work at the Norwegian Veterinary Institute, 18 sheep, one cattle, and two goats were tested serologically for Toxoplasma. None were positive.

Evaluation of the current situation

T. gondii is prevalent in Norway, but is less prevalent than in southern Europe. It has been estimated that 90% of Norwegian women are susceptible to infection, and that 2 of 1000 pregnant women contract the infection for the first time during pregnancy. The parasite is estimated to transmit to the foetus in approximately 50% of these cases.

T. gondii is prevalent in several mammals in Norway, in particularly cats and sheep. In an investigation of lambs in the 1990s, 18% of the tested lambs had antibodies against *Toxoplasma*, and positive animals were found in 44% of the tested flocks. Similarly, in a study performed between 2002 and 2008, 17% of tested goats were antibody-positive, and positive animals were found in 75% of the tested herds. In another study, performed in the 1990s, 2.6% of pigs for slaughter were antibody positive.

Wild deer may be infected with *T. gondii*. In a serological study of 4300 deer hunted between 1992 and 2000, 34% roe deer, 13% elk, 5% hart deer and 1% reindeer were antibody positive.

Rabies

The disease and its transmission routes

Rabies is caused by a lyssavirus, and the infection manifests itself as a neurological disease. The virus transmits through bites, or from exposure of open wounds to saliva from rabid animals. The incubation period is usually 1-3 months but may be longer. Untreated rabies is fatal. In Europe, classic rabies and bat rabies are caused by different virus. Bat rabies in Europe has a much lower zoonotic potential than classic rabies.

Surveillance and control

Rabies is notifiable both in humans and in animals (group A disease). A vaccine is available for people who are traveling to high risk areas for extended periods. The vaccine is also used in combination with anti-serum to treat people who may be infected with rabies.

Animals with rabies will be euthanized, and measures will be implemented to stop further spread. From the 1st January 2012, dogs and cats imported from EU and EEA countries are only requested to be vaccinated against rabies. Previously, a blood test to prove sufficient antibody titres was also mandatory. For dogs and cats imported from non EU non EEA countries, both a rabies blood test and proof of antibody titre is requested.

Results 2016

Rabies was not detected in humans in Norway in 2016.

Five dogs, and 14 arctic foxes (from Svalbard) were tested for rabies at the Norwegian Veterinary Institute. All were negative. For further information see the Appendix.

Evaluation of the current situation

In rare cases, bat rabies may transmit from bats to other warm-blooded animals, including humans. Therefore, care is advised when handling bats, and any bite from a bat should be consulted with a doctor. It is not considered necessary to start vaccinating animals in Norway due to the detection of bat rabies in 2015.

Classic rabies has never been detected in mainland Norway, but it has been detected in Arctic fox, reindeer and seals in Svalbard. The last detection was in 2011-2012 and before that 1999. It is important that persons living in or traveling to Svalbard are aware that rabies may occur among wild animals there and take necessary precautions.

Dogs imported to Norway without vaccination may confer a risk of introducing rabies. In a study performed at the Norwegian Veterinary Institute in 2012, approximately 50% of dogs imported from Eastern Europe had most likely not been properly vaccinated. Illegal import of dogs to Norway poses a threat to human and animal health due to the risk of introducing rabies to the country.

Q-fever

The disease and its transmission routes

Q-fever is caused by the bacteria *Coxiella burnetii*, and is mainly associated with ruminants. However, also humans and other animals may become infected and sick. The bacteria are shed in urine, faeces, foetal fluids, placenta and foetal membranes, and can survive for extended periods in the environment. Transmission is airborne via aerosols. In animals, infection results in weak offspring, abortions, infections of the placenta and uterus. In humans *C. burnetii* may cause influenza-like symptoms and rarely more serious disease.

Surveillance and control

Q-fever in humans has been notifiable in Norway since 2012, and is a group C-disease in animals. Animals with clinical signs of Q-fever must not have contact with animals from other herds/farms and the Food Control Authority may impose restrictions on animal holdings that are suspected to be infected and where infection is confirmed.

Results 2016

Two cases of Q-fever in humans were reported, and in both cases the infection had been contracted abroad.

At the Norwegian Veterinary Institute, blood samples from a total of 171 cattle and 3 alpaca were tested serologically for *C. burnetii*, and all samples were negative. For further information see the Appendix.

Evaluation of the current situation

Q-fever does not represent a problem for human or animal health in Norway at present. The infection became notifiable in humans in 2012, and since then only 6 cases have been reported. All six were infected abroad.

Q-fever has not been detected in Norwegian animals. Screening studies were performed in 2008 (460 bovine dairy herds and 55 bovine meat herds), in 2009 (349 goat herds and 45 bovine herds) and in 2010 (3289 bovine dairy herds). After this, testing has been performed on imported animals and as part of diagnostic testing on sick animals.

BSE and vCJS

The disease and its transmission routes

Bovine spongiform encephalopathy (BSE, mad cow disease) in cattle and Creutzfeldt-Jacob disease (CJS) in humans are transmissible spongiform encephalopathies (TSE). The diseases cause spongy degeneration of the brain and spinal cord, and are fatal. The infective agents are prions, protein structures without DNA. A form of CJS, variant CJS (vCJS) was first described as the cause of death in a person in the UK in 1995. The disease was suspected to be caused by consumption of beef containing the prion associated with classic BSE.

Other TSE-diseases that do not transmit between animals and humans have also been described, such as atypical BSE in cattle, scrapie in sheep, sporadic CJS in humans and chronic wasting disease (CWD) in deer.

Surveillance and control

Surveillance for BSE started in Norway in 1998, and includes testing of imported animals and their offspring, emergency slaughtered cattle, cattle with certain clinical signs at slaughter and a selection of regularly slaughtered cattle. All small ruminants with scrapie are tested to rule out BSE.

At slaughter, specified risk material (SRM) is removed from cattle and small ruminants. It is forbidden to use protein from animal (including fish protein) in feed for ruminants. Norway banned the use of bone meal in ruminant feed already in 1990.

Results 2016

No cases of CJC were reported in humans.

In total, 6 927 cattle were tested, and all were negative for BSE.

Evaluation of the current situation

The situation with respect to classic BSA is favourable in Norway. The beneficial situation is largely due to restricted and controlled import of live animals and bone meal, and the surveillance program for BSE. In addition, strict regulations with respect to heat treatment of and use of bone meal. Atypical BSE was detected in 2015 for the first time in Norway. Atypical BSE occurs spontaneously, and is not zoonotic.

Antimicrobial resistance

Infections with antimicrobial resistant bacteria can be difficult to treat. Such bacteria may be zoonotic and may transmit through direct or indirect contact, including through food. One example is *Salmonella spp.*, and another is methicillin resistant *Staphylococcus aureus* (MRSA). The latter was previously mainly associated with humans, but is now also found in animals, particularly swine, and may transmit from animals to humans directly or indirectly.

Surveillance and control

Infection/carriage with some forms of antimicrobial resistant bacteria in humans, such as MRSA, is notifiable in Norway. In addition, selected microbes from certain infections, and their resistance profiles, are reported annually in the the NORM surveillance programme for antimicrobial resistance in human pathogens.

Since 2000, Norway has also had a surveillance programme for antimicrobial resistance in pathogens from animals, feed and food (NORM-vet), and in 2013 a separate surveillance program for MRSA in swine was established. No forms of antimicrobial resistant pathogens are notifiable in animals or in food in Norway. However, Norway has chosen a strategy to eradicate MRSA from swine, and for this reason any detection of MRSA in production animals should be reported to the Food Safety Authority.

Results 2016

Details on detection of selected pathogens in humans and animals and their antimicrobial resistance are presented the annual NORM/NORM-vet reports (<http://www.vetinst.no/overvaking/antibiotikaresistens-norm-vet>). The occurrence of antibiotic resistant bacteria is still limited in both humans and animals in Norway compared to other countries.

As part of the national surveillance programme for MRSA in swine, 872 herds were tested. One was positive and so were two contact herds. In addition, five swine herds, tested for other reasons than the surveillance program, were positive for MRSA. Samples for MRSA-testing were also collected from 121 mink farms and all were negative. As part of the diagnostic work at the TINE dairy cooperative mastitis laboratory, a milk sample (quarter sample) from a cow was positive for MRSA. The dairy herd was followed up with extended sampling and measures to eliminate the bacteria from the herd were implemented. The herd was later tested negative for MRSA.

Evaluation of the current situation

Increasing occurrence of antimicrobial resistance in bacteria is a serious threat to human and animal health, globally. Thanks to restricted use of antibiotics to animals, and controlled use in humans, the situation is better in Norway than in most other countries. However, the situation is threatened by the high use of antibiotics globally, traveling, import of food and spread of antibiotic resistant pathogens in food production.

Resistant pathogens may spread with healthy carriers. MRSA was (and is) most likely introduced to Norwegian swine production with foreign labourers carrying the bacteria, and thereafter was further spread through trade with live animals. From swine MRSA may transmit back to humans through direct or indirect contact. This form of transmission, from humans to animals and back again, is difficult to control, and in this respect MRSA is an example of a modern challenge in infection control in Norwegian food production. In cases where MRSA is found in dairy herds, it is advised not to drink unpasteurized milk from the farm.

Foodborne outbreaks

An outbreak is either defined as more cases than expected of a specific disease, within a defined geographical area and time period, or as two or more disease cases with a common source of infection. In 2005, the Norwegian Public Health Institute (NIPH) and the Norwegian Food Safety Authority introduced a web-based system for reporting outbreaks (Vesuv). The system covers the duty of the specialist- and municipal health services to notify outbreaks, and the voluntary reporting of the Food Safety Authority. The system is used to report outbreaks to the NIPH. The following outbreaks should be reported to Vesuv: outbreaks of diseases that are notifiable in MSIS; outbreaks believed to be associated with food or water; outbreaks caused by particularly serious infections; particularly extensive outbreaks; and outbreaks in health care institutions. The four last categories also include infections that are not notifiable in MSIS.

The purpose of solving food borne outbreaks is to stop the outbreak and prevent future disease cases by corrective measures. According to the regulation on infection control (§ 7-2) the District Medical Officer is responsible for organizing and leading the work to investigate and solve a disease outbreak in his/her municipality. Proper outbreak investigation requires cooperation between local and central health authorities, the Food Safety Authority and sometimes also other authorities.

Results 2016

In 2016, the NIPH received 29 notifications through Vesuv of possible or confirmed food borne outbreaks outside health institutions. In total, 498 persons were reported to have become sick in these outbreaks. The number of affected persons in each of the outbreaks varied between 2 and 60 (median 9). The most common infective agent was Norovirus (11 outbreaks) followed by *Campylobacter* (2 outbreaks). In 12 of the outbreaks, causative agent was not identified. The number of reported outbreaks was lower than in 2015 (Figure 7.).

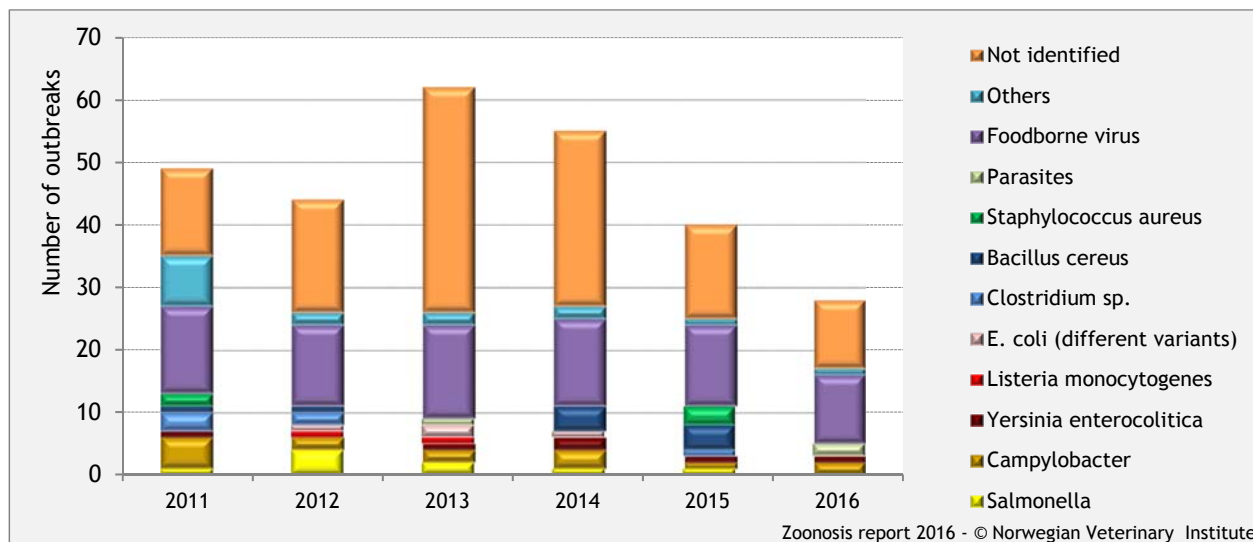


Figure.7. The number of reported outbreaks where an agent was verified and where the agent was strongly suspected.

Appendix Tables 2016

Table 1. Human population of Norway

Table 2. Animal population of Norway

Table 3. *Salmonella* serovars in humans in Norway

Table 4. Human cases of campylobacteriosis distributed by county

Table 5. Foodborne outbreaks

Table 6. Selected zoonoses in animals

Table 7. *Salmonella* in animals

Table 8. *Salmonella* in food

Table 9. *Salmonella* in feed and feed components

Table 1. Human population of Norway per 1st January 2017 (from statistics Norway).

Age group	Female	Male	Total
0 - 9	304 698	321 606	626 304
10 - 19	309 309	327 117	636 426
20 - 29	346 602	364 638	711 240
30 - 39	339 299	360 726	700 025
40 - 49	360 526	381 204	741 730
50 - 59	327 208	343 345	670 553
60 - 69	284 852	285 819	570 671
70 - 79	199 072	181 316	380 388
80 - 89	105 538	70 833	176 371
90 -	32 083	12 526	44 609
Total	2 609 187	2 649 130	5 258 317

Table 2. Animal population of Norway in 2016.

Animal species - category	Number*		
	Herds /flocks	Animals	Slaughtered animals
Cattle - total	14 000 ^a	870 000 ^a	286 000 ^b
Dairy production	8 500 ^a	222 000 ^a	
Meat production	5 000 ^a	85 200 ^a	
Combined dairy/meat	770 ^a	34 400 ^a	
Sheep - total	14 600 ^a	2 469 000 ^a	1 285 000 ^b
Sheep >1 year	14 500 ^a	951 000 ^a	
Goats - total	1 300 ^a	68 500 ^a	23 800 ^b
Dairy goats	300 ^a	34 900 ^a	
Swine - total	2 200 ^a	822 000 ^a	1 651 000 ^b
Breeding pigs	1 100 ^a	49 800 ^a	
Slaughter pigs	2 000 ^a	448 000 ^a	
Chickens (<i>Gallus gallus</i>)			
Grandparent stock - egg producers	2 (3) ^{c1}		
Parent stock - egg producers	11 (13) ^{c1}		
Parent stock - broiler	109 (147) ^{c1}		
Laying hens	550 (845) ^c		
Broilers	669 (4 547) ^c		67 924 000 ^d
Turkey, goose and duck			
Parent stock	9 (19) ^{c1}		
Meat production	74 (306) ^c		1 513 000 ^d
Horse			250 ^b
Reared deer	80 ^e	7 500 ^e	

* Numbers are rounded: For numbers between 100 and 1000 nearest 10; between 1 000 - 10 000 nearest 100, between 10 000 and 100 000 nearest 1 000 and for numbers >100 000 nearest 10 000.

^a Figures from the registry of production subsidy per 31.7.2016.

^b Figures from Statistics Norway (Public meat inspection. Carcasses approved for human consumption. Number of animals)

^c Figures from the surveillance programme for Salmonella

^d Figures from the Norwegian Agriculture Agency (based on delivery for slaughter)

^e Figures from the Norwegian Agriculture Agency - per 31.7.2016

¹ Production flocks only.

Table 3. The eleven most common *Salmonella* serovars found in humans in Norway in 2016.

Serovar	Place of infection			Total
	Norway	Abroad	Unknown	
<i>S. Enteritidis</i>	38	262	23	323
<i>S. Typhimurium</i>	40	33	9	82
<i>S. Typhimurium monofasisk variant</i>	30	61	10	101
<i>S. Stanley</i>	7	35	3	45
<i>S. Newport</i>	3	20	3	26
<i>S. Chester</i>	1	17	0	18
<i>S. Agona</i>	4	11	1	16
<i>S. Infantis</i>	0	13	3	16
<i>S. Java</i>	0	11	3	14
<i>S. Saintpaul</i>	3	10	0	13
<i>S. Virchow</i>	2	9	1	12
Andre	47	123	29	199
Totalt	175	605	85	865

Table 4. Human cases of campylobacteriosis distributed by county. Only cases verified by culturing (notifiable to MSIS) are included in the table.

County	2008	2009	2010	2011	2012	2013	2014	2015	2016
Østfold	62	52	34	63	52	66	70	35	58
Akershus	99	88	92	91	108	120	130	48	38
Oslo	86	129	109	113	136	103	121	43	41
Hedmark	43	53	39	39	28	50	49	29	49
Oppland	62	45	33	69	68	60	66	49	56
Buskerud	47	65	42	48	63	60	60	9	5
Vestfold	69	47	57	42	51	42	70	25	26
Telemark	33	41	25	37	39	34	49	35	33
Aust-Agder	20	13	9	18	20	14	33	9	21
Vest-Agder	20	22	27	45	34	41	48	25	35
Rogaland	157	162	149	177	124	169	129	101	127
Hordaland	125	174	131	136	128	115	155	104	135
Sogn & Fjordane	20	44	25	45	24	27	27	33	18
Møre & Romsdal	39	64	56	54	36	47	73	26	34
Sør-Trøndelag	107	120	92	85	115	95	117	76	79
Nord-Trøndelag	36	40	40	28	31	29	34	19	34
Nordland	33	40	32	47	31	46	60	49	38
Troms	33	34	15	25	20	23	55	40	57
Finnmark	11	22	12	13	6	6	19	17	21
Totalt	1 102	1 255	1 019	1 175	1 114	1 147	1 365	884	969

Table 5. Foodborne outbreaks.

Agent	2011	2012	2013	2014	2015	2016
<i>Salmonella</i> sp.	1	4	2	1	1	
<i>Campylobacter</i> sp.	5	2	2	3	1	2
<i>Yersinia enterocolitica</i>	1		1	2	1	1
<i>Listeria monocytogenes</i>		1	1			
<i>Escherichia coli</i>		1	2	1		1
<i>Clostridium</i> sp.	3	2			1	
<i>Bacillus cereus</i>	1	1		4	4	
<i>Staphylococcus enterotoxin</i>	2				3	
Parasites			1			2
Virus	14	13	15	14	13	11
Other	8	2	2	2	1	1
Unknown	14	18	36	28	15	11
Total	49	44	62	55	40	29

Table 6. Selected zoonoses in animals in 2016. *Salmonella* is presented in separate tables.

Infection/agent	Category	Number tested	Number positive	Comment
Campylobacteriosis	Broiler chicken flocks - surveillance	2 262	175	May - October
	Cattle - diagnostics	124	31	<i>C. jejuni</i>
	Sheep - diagnostics	26	3	<i>C. jejuni</i>
	Goat - diagnostics	1	1	
	Swine - diagnostics	11	7	<i>C. coli</i>
	Horse - diagnostics	1	0	
	Dog - diagnostics	215	66	<i>C. upsaliensis</i> (49), <i>C. sp.</i> (8), <i>C. jejuni</i> (9)
	Cat - diagnostics	38	3	<i>C. jejuni</i>
Tuberculosis	Cattle - surveillance	3	0	
	Cattle - tuberculin testing	158	0	
	Swine - tuberculin testing	195	0	
	Swine - diagnostics	10	0	
	Alpaca - surveillance	1	0	
	Llama - surveillance	2	0	
	Sheep - diagnostics	1	0	
Brucellosis	Cattle - surveillance	147	0	
	Cattle - breeding animals, export	232	0	
	Sheep - surveillance	9 821	0	
	Sheep - export, trade	5	0	
	Goat - surveillance	2 312	0	
	Swine - breeding stock	1 944	0	
	Dog	16	0	Suspicion of disease (5), export (11)
	Alpaca - import	3	0	
	Camel - import	2	0	
	Gris, horse	All slaughtered*	0	
Echinococcosis	Fox - surveillance	575	0	
	Wolf - surveillance	8	0	
	Cattle, small ruminants, swine, horse	All slaughtered*	0	
Toxoplasmosis	Sheep - diagnostics	18	0	
	Cattle - diagnostics	1	0	
	Goat - diagnostics	2	0	
Rabies	Dog - diagnostics	5	0	
	Arctic fox (Svalbard)	14	0	
Q-fever	Cattle - export	18	0	
	Cattle - diagnostics	6	0	
	Cattle - surveillance	147	0	
	Alpaca - import	3	0	
BSE	Cattle	6 927	0	

* For total numbers see Table 2.

Table 7. *Salmonella* in animals 2016.

Category	Number* tested	Number* positive	Comment
Chicken - surveillance - breeding flocks	163	0	
Chicken - surveillance - layer flocks	845	1	<i>S. Typhimurium</i>
Chickens - surveillance - broiler flocks	4 547	2	<i>S. Bareilly</i> , <i>S. Typhimurium</i>
Chicken flocks - other samples	12	0	
Turkey, ducks, geese - surveillance - breeding flocks	19	0	
Turkey, ducks, geese - surveillance - meat flocks	306	0	
Turkey, ducks, quale, various other flocks	5	0	
Cattle - surveillance - animals	3 137	0	
Cattle - diagnostics - herds	85	1	<i>S. diarizonae</i>
Sheep - diagnostics - flocks	22	3	<i>S. diarizonae</i>
Goats- diagnostics - herds	4	0	
Swine - surveillance - slaughter pigs - animals	1 806	1	<i>S. Typhimurium</i>
Swine - surveillance - sows - animals	1 456	0	
Swine - surveillance - flocks	89	0	
Swine - diagnostics - flocks	25	0	
Horse - diagnostics - flocks	14	0	
Dogs - diagnostics	257	2	<i>S. Typhimurium</i>
Cat - diagnostics	42	6	<i>S. Typhimurium</i>
Rabbit	3	0	
Alpaca - animals, import	1	0	
Alpaca- flocks - diagnostics	3	0	
Animals/birds/zoo birds/zoos	43	5	All positive were reptiles and one monkey, 5 different serovars
Various pet birds	3	0	
Various wild animals	25	0	
Wild birds	94	12	<i>S. Typhimurium</i>

* Units for numbers are given in the first column.

Table 8. *Salmonella* in food 2016.

Category	Number sampled	Number positive	Comments
Cattle - swab of carcass - surveillance	3 012	0	
Swine - swab of carcass - surveillance	3 224	0	
Meat scrapings (cattle, swine. sheep) - surveillance	3 011	2	<i>S. diarizonae</i>
Fish - Norwegian - NIFES	119	0	
Fisk - Imported - NIFES	102	0	
Shellfish- Norwegian - NIFES	38	0	

Table 9. *Salmonella* in feed and feedstuffs 2016.

Category	Number tested*	Number positive	Comments
Feedstuff			
Barley, oats	0	0	
Wheat	155	0	
Corn	298	3	
Rape	424	2	
Soya	2 846	1	
Sunflower	29	1	
Peas etc.	117	0	
Ground nut etc.	69	0	
Other plant based feedstuffs	31	2	
Meat based feedstuff	335	5	
Marine based feedstuff	92	1	
Feed			
Domestic animals (cattle, swine, poultry)	434 (72)	1	
Fish	3 409 (77)	4	
Fur animals	183	0	
Environmental samples in factories producing feed and feedstuff	14 216	114	

* Total numbers are presented, in brackets the number of samples collected by Authorities.

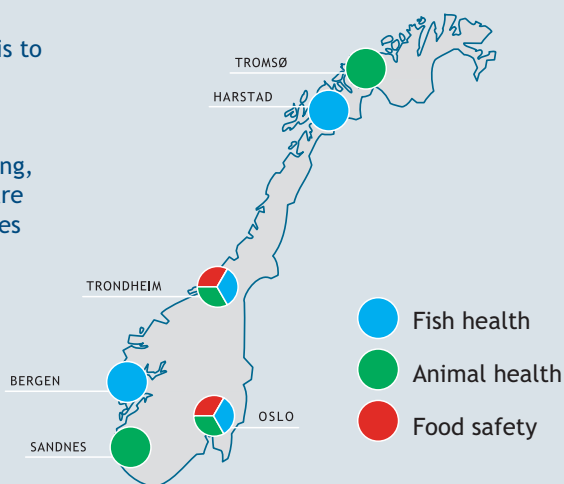
*Scientifically ambitious, forward-looking and cooperatively oriented
– for integrated health*

The Norwegian Veterinary Institute is a national research institute that operates in the fields of animal and fish health, food safety and feed hygiene; its primary task is to provide the authorities with independently generated knowledge.

Emergency preparedness, diagnostic services, monitoring, reference functions, consulting, and risk assessments are all important areas of activity. Our products and services include research results and reports, analyses and diagnoses, studies and advice.

The Norwegian Veterinary Institute's central laboratory and administration lie in Oslo, and we operate regional laboratories in Sandnes, Bergen, Trondheim, Harstad and Tromsø.

The Norwegian Veterinary Institute collaborates with a large number of national and international institutions.



Fish health



Animal health



Food safety



Oslo
postmottak@vetinst.no

Trondheim
vit@vetinst.no

Sandnes
vis@vetinst.no

Bergen
post.vib@vetinst.no

Harstad
vih@vetinst.no

Tromsø
vitr@vetinst.no

www.vetinst.no



Veterinærinstituttet
Norwegian Veterinary Institute