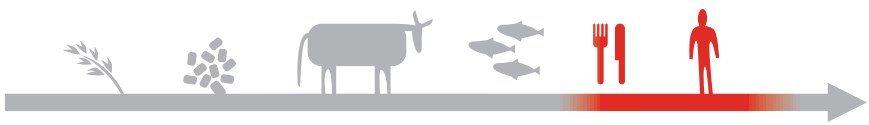
Report 9b - 2016

The Norwegian Zoonoses Report 2015



Veterinærinstituttet
Norwegian Veterinary Institute

The Norwegian Zoonoses Report 2015

Content

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Summary

Despite detection of two «new» diseases in animals in Norway in 2015, bat rabies and atypical BSE in cattle, the overall situation in 2015 was good with respect to zoonoses in animals, food and feed. In humans, the situation for many of the zoonoses was also better compared to previous years. One exception was *E. coli* (VTEC), where an increase in the number of cases was registered in 2015. This increase can, however, be partly explained by changed diagnostic methods.

Bat rabies was detected for the first time in Norway in 2015, in a bat found in Valdres. Bat rabies in Europe is caused by variants of the virus that are not as dangerous zoonoses as the classic rabies known from foxes, dogs and other animals.

BSE (atypical variant) was also detected for the first time in Norway in 2015. However, this form of BSE is not considered a zoonosis like mad cow disease, which is caused by classic BSE.

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. The Food Safety Authorities decide which surveillance programmes that are carried out. 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. 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 is responsible for inspecting the food industry to ensure that these exercise their responsibility. Food producers must also consider zoonosis 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.

Tabell 1. Disease/agents that are included in the zoonosis report in 2015 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 *E. coli*	Yes	No*	No*	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

* If samples from internal control in companies are positive, measures are implemented to eliminate the problem.
** 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.

Acknowldegements

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 2015

The number of reported cases of salmonellosis in humans (928) is the lowest in 20 years (Figure 1). Information on the detected serotypes is presented in the Appendix.

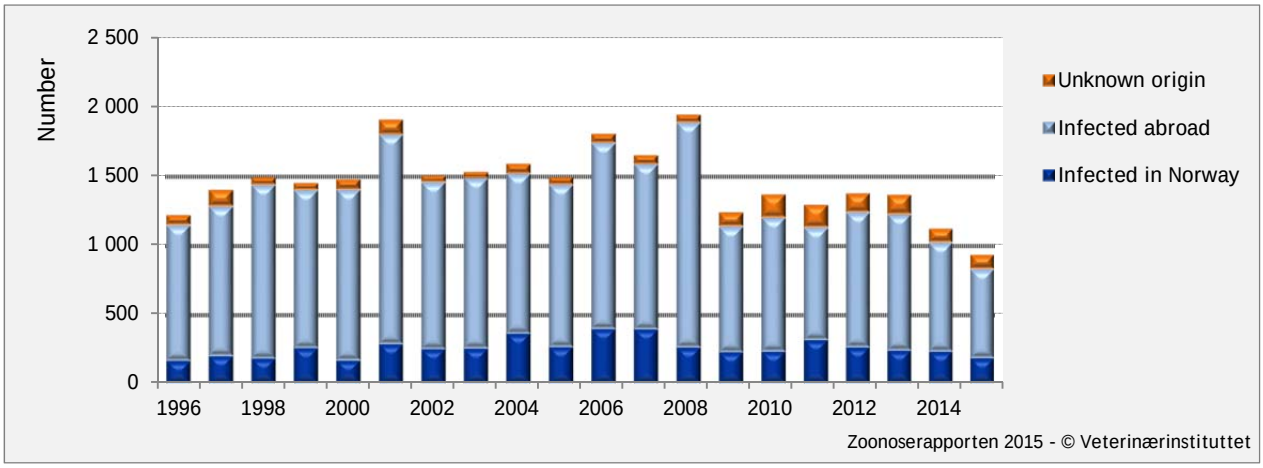


Figure 1. Reported cases of salmonellosis in humans. Data from MSIS.

One *Salmonella* positive broiler flock was detected in the surveillance programme. 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. About 80% 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.

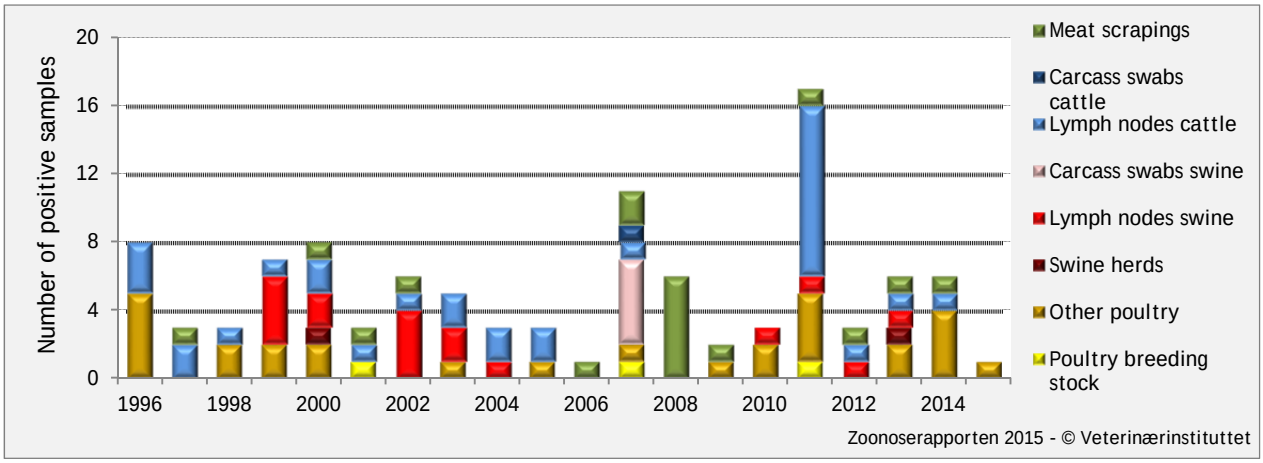


Figure 2. The number of positive samples in the *Salmonella* surveillance programme.

Salmonella is occasionally detected in dogs and cats and reptiles in Norway. Infected pets may constitute a risk for infection of 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.

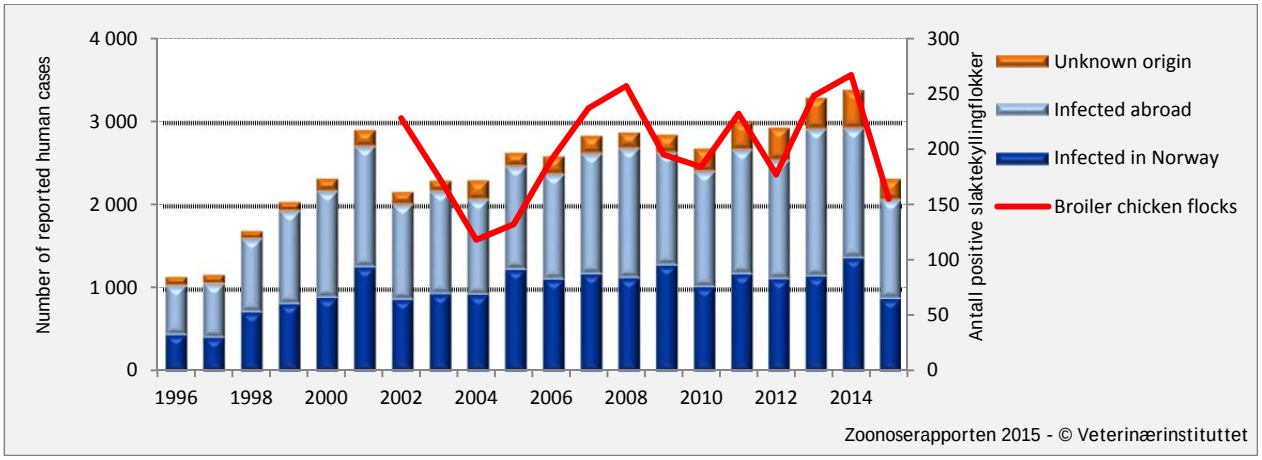
Surveillance and control
Campylobacteriosis is notifiable in humans in Norway, but not in animals.

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 2015

In MSIS, 2318 culture-positive human cases were reported, and 878 of these contracted the infection in Norway. In addition, 708 cases were positive for *Campylobacter* by PCR, and 218 of these were infected in Norway. Altogether, the number of positive cases in humans (culturing+PCR) for 2015 was similar to recent years.

For broiler flocks, 2015 was the "best" year for a long time with an estimated 155 flocks positive.
In the diagnostic services at the Norwegian Veterinary Institute, *Campylobacter* was detected in samples from 34 cattle, 75 dogs and 2 cats. For details see the Appendix.



Figur 3. The number of reported cases of campylobacteriosis in humans (data from MSIS) and the number of positive broiler flocks (For 2008 the numbers are an estimate – see details in the surveillance report).

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 *Campylobacte*r in these animals in Norway. However, one study showed that eating inadequately heat treated pork was associated with an increased risk of *Campylobacte*r 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 is low in Norway (3-6 % of slaughtered flocks) 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.

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 2015

The number of reported cases of yersiniosis (76) was similar to previous years (Figure 4)

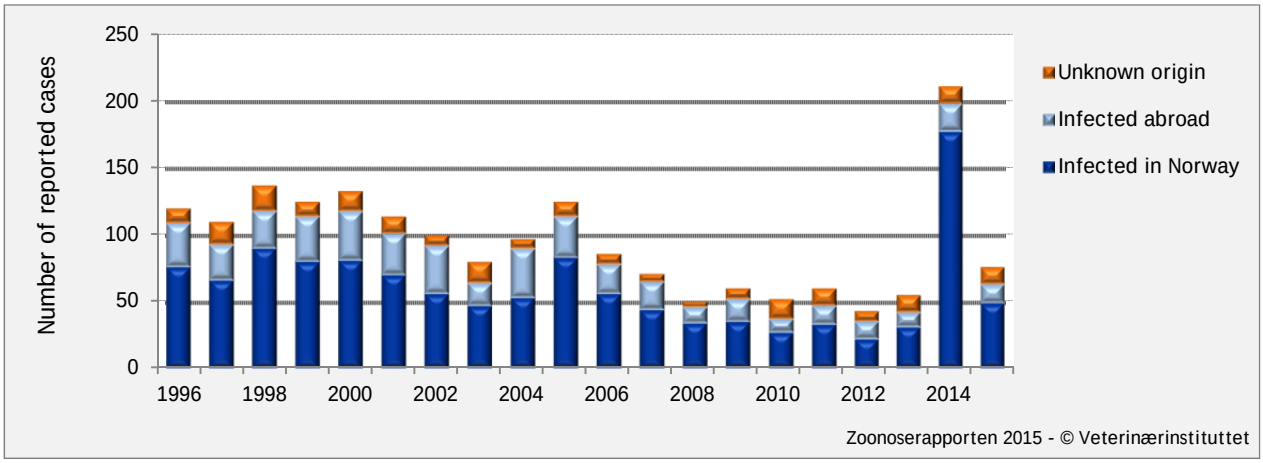


Figure 4. The number of reported cases of yersiniosis in humans. Data from MSIS.

In the diagnostic services at the Norwegian Veterinary Institute, *Y. enterocolitica* was detected in samples from 3 muskox, one reindeer and one pig. *Y. pseudotuberculosis* was detected from a cat.

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 mains 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.

Results 2015

The number of cases of listeriosis in humans (18) was the lowest since 2015 (Figure5.).

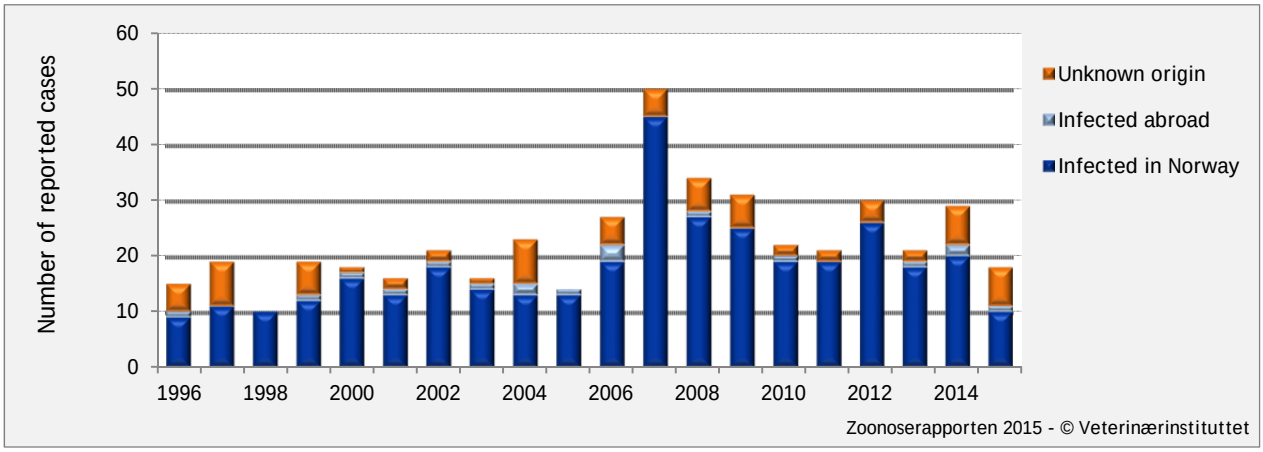


Figure 5. The number of cases of listeriosis in humans. Data from MSIS.

The National Institute of Nutrition and Seafood Research (NIFES) examined 215 samples of seafood for *L. monocytogenes* and 2 samples were positive, but had less than 100 cfu/g. The Norwegian Food Safety Authority collected 250 samples from food and production facilities, and 5 of these were positive.
At the Norwegian Veterinary Institute, *L. monocytogenes* was detected in diagnostic samples from 15 sheep, 6 goats and 1 cow.

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 2015

The number of reports in humans (221) is the highest since the infection became notifiable (Figure 6.).

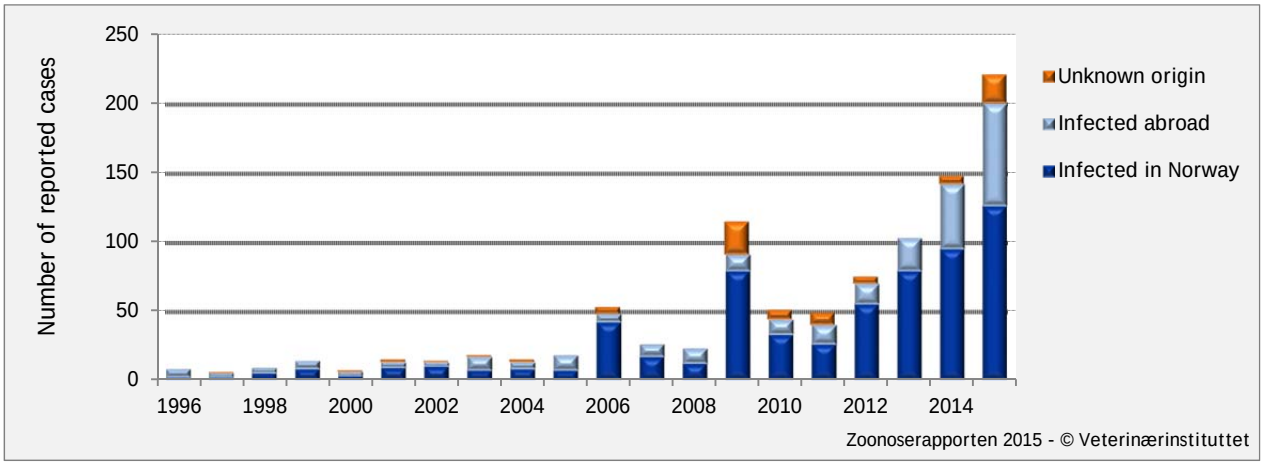


Figure 6. The number of reported cases of EHEC (enterohaemorrhagic *E. coli*) in humans. Data from MSIS.

In connection with eight cases of EHEC-associated disease in humans, a total of 24 samples, mostly food, 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 a transition to non-culture based diagnostics in the major microbiological laboratories. 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.

Results 2015

One case of *M. bovis* infection in a human, considered to have been infected abroad, was reported.

All cattle, sheep, goats, swine and horses commercially slaughtered in 2015 were examined post mortem. In addition, 924 breeding pigs and 195 breeding bulls were tuberculin tested. As part of diagnostic testing, samples from 7 alpacas, 5 llamas, 2 cattle, 1 pig and 1 sheep 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 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 2015

Two cases of brucellosis in humans were reported. Both were infected abroad.

In the surveillance programme, 113 cattle from 51 herds, 9418 sheep from 3353 flocks, 3048 goats from 97 herds were tested. All samples were negative. In addition, 2485 swine, 331 cattle, 37 sheep, 41 alpakka, 24 dogs, 4 moose and 16 reindeer 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 2015

No cases of Trichinellosis were reported in humans.

In addition to testing of all slaughtered pigs and horses, one wild boar was tested after hunting. This animal was positive for *Trichinella.* 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. *Trinchinella* 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 2015

Two cases of Echinococcosis in humans were reported, both cases had contracted the infection abroad.

In the surveillance program for *E. multilocularis*, 523 foxes and 4 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, 4462 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 2015

As part of the diagnostic work at the Norwegian Veterinary Institute, 23 sheep, 2 cattle, 1 goat and 1 hare were tested serologically for Toxoplasma. Only the hare was 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 though 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-serumto 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 2015

Rabies was not detected in humans in Norway in 2015.

Bat rabies (EBLV-2) was detected for the first time in Norway, in a sick bat found in Valdres, mid Norway.

Three dogs, 11 arctic foxes (from Svalbard) and one wild mink were tested at the Norwegian Veterinary Institute. All were negative for rabies. 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 aniamals 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 2015

One case of Q-fever in a human was reported. The infection had been contracted abroad.

At the Norwegian Veterinary Institute, blood samples from a total of 118 cattle and 117 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 2015

No cases of CJC were reported in humans.

In total, 6781 cattle were tested and atypical BSE was detected in one animal. Atypical BSE is a variant of BSE that occurs spontaneously, is not transmissible, and is not a zoonosis. This was the first report of BSE in Norway.

Evaluation of the current situation

Atypical BSE was detected in 2015 for the first time in Norway. This does not, however, alter previous assessments of the situation in Norway, which is still very good with respect to zoonotic BSE (classic BSE). 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.

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. Cephalosporin-resistant *Escherichia coli* that produce the enzyme "extended spectrum betalactamase" (ESBL-producing *E. coli*) may be found in poultry and may transmit to humans through poultry meat.

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 2015

Details on detection of selected pathogens in humans and animals and their antimicrobial resistance are presented the annual NORM/NORM-vet reports.

As part of the national surveillance programme for MRSA in swine, 821 herds were tested. Four were positive and were followed up in order to eradicate the pathogen from the herd. In total, 179 bovine herds were examined for MRSA and one was positive. Contacts of MRSA-positive animal holdings are routinely tested for MRSA. In this context, 30 additional positive herds were identified in 2015, and measures to eradicate the pathogen from the herds were imposed by the Food Safety Authority.

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.

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 2015

In 2015, the NIPH received 40 notifications through Vesuv of possible or confirmed food borne outbreaks outside health institutions. In total, 483 persons were reported to have become sick in these outbreaks. The number of affected persons in each of the outbreaks varied between 2 and 73 (median 9). The most common infective agent was Norovirus (13 outbreaks) followed by *Bacillus cereus* (4 outbreaks and *Staphylocccus aureus* (3 outbreaks). The number of reported outbreaks was lower than in 2014 (Figure 7.).

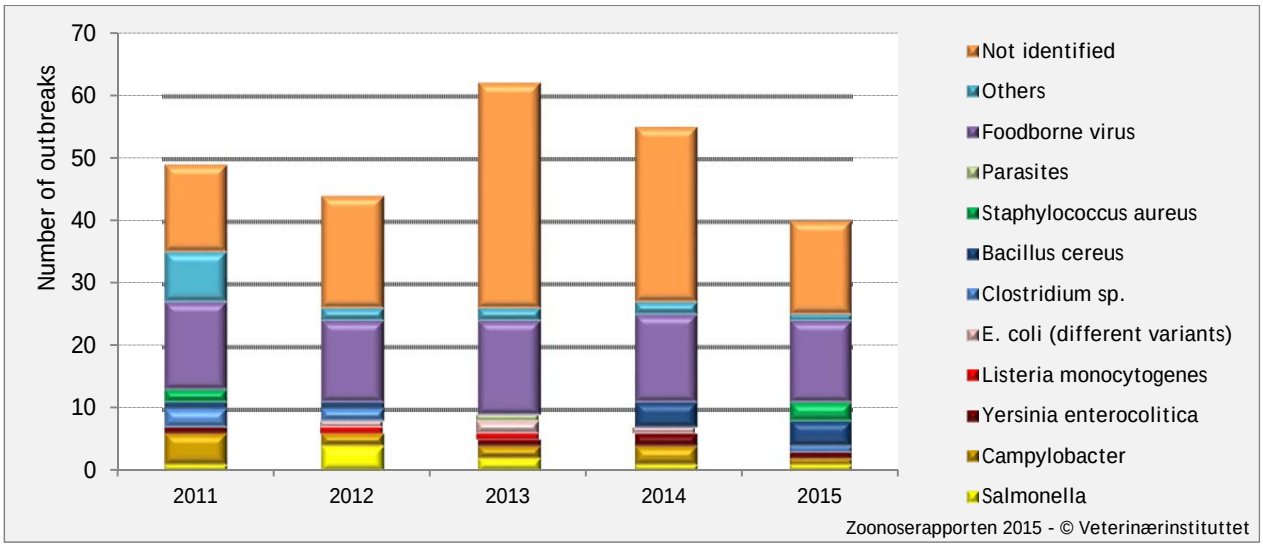


Figure.7. The number of reported outbreaks where an agent was verified and where the agent was strongly suspected.

Appendix Tables 2015

Table 1. Human population of Norway per 1st January 2016 (from statistics Norway).

Age group	Female	Male	Total
0 - 9	305 115	321 461	626 576
10 - 19	308 954	325 249	634 203
20 – 29	344 190	361 151	705 341
30 – 39	335 580	358 087	693 667
40 – 49	362 093	384 194	746 287
50 – 59	323 181	338 546	661 727
60 – 69	284 523	285 788	570 311
70 – 79	187 247	168 601	355 848
80 – 89	106 165	69 914	176 079
90 -	31 826	12 120	43 946
Total	**2 588 874**	**2 625 111**	**5 213 985**

Table 2. Animal population of Norway in 2015.

Animal species - category	Number*		
	Herds /flocks	Animals	Slaughtered animals
Cattle - total	14 200[a]	854 000[a]	284 000[b]
Dairy production	8 000[a]	201 000[a]	
Meat production	4 100[a]	70 000[a]	
Combined dairy/meat	740[a]	31 800[a]	
Sheep - total	14 300[a]	2 400 000[a]	1 228 000[b]
Sheep >1 year	14 200[a]	912 000[a]	
Goats - total	1 300[a]	66 900[a]	24 000[b]
Dairy goats	300[a]	33 700[a]	
Swine - total	2 100[a]	818 000[a]	1 605 000[b]
Breeding pigs	1 100[a]	51 000[a]	
Slaughter pigs	1 900[a]	449 000[a]	
Chickens (*Gallus gallus*)			
Grandparent stock – egg producers	2 (3)[c1]		
Parent stock – egg producers	7 (13)[c1]		
Parent stock – broiler	96 (140)[c1]		
Laying hens	580 (850)[c]		
Broilers	700 (4 400)[c]		63 406 000[d]
Turkey			
Parent stock	5 (17)[c1]		
Meat production	73 (200)[c]		1 261 000[d]
Duck			
Parent stock	5 (7)[c1]		
Meat production	13 (110)[c]		296 500[d]
Goose			
Parent stock	1 (1)[c1]		
Meat production	4 (9)[c]		
Horse			330[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 31.7.2015.
[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 31.7.2015
[1] Production flocks only.

Table 3. The eleven most common *Salmonella* serovars found in humans in Norway in 2015.

Serovar	Place of infection			Total
	Norway	Abroad	Unknown	
S. Enteritidis	38	278	35	351
S. Typhimurium	58	59	14	131
S. Typhimurium monophasic variant	24	65	14	103
S. Stanley	10	27	3	40
S. Newport	3	20	2	25
S. Java	1	14	1	16
S. Virchow	2	10	1	13
S. Braenderup	2	8	2	12
S. Thompson	1	9	2	12
S. Agona	2	9	1	12
S. Kentucky	0	11	1	12
Others	42	134	25	201
Total	**183**	**644**	**101**	**928**

Table 4. Human cases of campylobacteriosis distributed by county.

County	2008	2009	2010	2011	2012	2013	2014	2015
Østfold	62	52	34	63	52	66	70	43
Akershus	99	88	92	91	108	120	130	66
Oslo	86	129	109	113	136	103	121	57
Hedmark	43	53	39	39	28	50	49	35
Oppland	62	45	33	69	68	60	66	46
Buskerud	47	65	42	48	63	60	60	9
Vestfold	69	47	57	42	51	42	70	34
Telemark	33	41	25	37	39	34	49	32
Aust-Agder	20	13	9	18	20	14	33	14
Vest-Agder	20	22	27	45	34	41	48	26
Rogaland	157	162	149	177	124	169	129	115
Hordaland	125	174	131	136	128	115	155	122
Sogn & Fjordane	20	44	25	45	24	27	27	26
Møre & Romsdal	39	64	56	54	36	47	73	34
Sør-Trøndelag	107	120	92	85	115	95	117	92
Nord-Trøndelag	36	40	40	28	31	29	34	25
Nordland	33	40	32	47	31	46	60	47
Troms	33	34	15	25	20	23	55	43
Finnmark	11	22	12	13	6	6	19	12
Total	**1 102**	**1 255**	**1 019**	**1 175**	**1 114**	**1 147**	**1 365**	**878**

Table 5. Foodborne outbreaks.

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

Table 6. Selected zoonoses in animals in 2015. *Salmonella* is presented in separate tables.

Infection/agent	Category	Number tested	Number positive	Comment
Campylobacteriosis	Broiler chicken flocks - surveillance	2 133	93	May - October
	Cattle - diagnostics	159	34	*C. jejuni*
	Sheep - diagnostics	24	6	*C. jejuni*
	Goat - diagnostics	4	0	
	Swine - diagnostics	2	0	
	Horse - diagnostics	2	0	
	Dog - diagnostics	266	75	*C. upsaliensis* (59), *C.* sp.(8), *C. jejuni* (6), *C. coli* (2)
	Cat - diagnostics	54	2	*C. jejuni*
Tuberculosis	Cattle – surveillance	2	0	
	Cattle – tuberculin testing	195	0	
	Swine – tuberculin testing	924	0	
	Swine - diagnostics	1	0	
	Deer – surveillance	0	0	
	Alpaca – surveillance	7	0	
	Llama - surveillance	5	0	
	Sheep - diagnostics	1	0	
Brucellosis	Cattle - surveillance	113	0	
	Cattle – breeding animals, export	331	0	
	Sheep – surveillance	9 418	0	
	Sheep – export, trade	37	0	
	Goat - surveillance	3 048	0	
	Swine – breeding stock	2 485	0	
	Dog	24	0	Suspicion of disease (4), import (2), export (18)
	Alpaca - import	41	0	
	Reindeer, elk, zoo, export	20	0	
Trichinellosis	Wild boar – hunted	1	1	
	Gris, horse	All slaughtered*	0	
Echinococcosis	Fox - surveillance	523	0	
	Wolf - surveillance	4	0	
	Cattle, small ruminants, swine, horse	All slaughtered*	0	
Toxoplasmosis	Sheep - diagnostics	23	0	
	Cattle - diagnostics	2	0	
	Goat - diagnostics	1	0	
	Hare - diagnostics	1	1	
Rabies	Dog – diagnostics	3	0	
	Bat - diagnostics	11	1	
	Arctic fox (Svalbard)	11	0	
	Mink (wild)	1	0	
Q-fever	Cattle - import	3	0	
	Cattle – diagnostics	5	0	
	Cattle - surveillance	110	0	
	Alpaca – import	117	0	
BSE	Cattle	6 781	1	Atypical BSE

* For total numbers see Table 2.

Table 7. *Salmonella* in animals 2015.

Category	Number* tested	Number* positive	Comment
Chicken – surveillance - breeding flocks	236	0	
Chicken – surveillance – layer flocks	995	0	
Chickens – surveillance – broiler flocks	4 437	1	*S*. Havana (1)
Chicken flocks – other samples	14	0	
Turkey, ducks, geese – surveillance - breeding flocks	28	0	
Turkey, ducks, geese – surveillance – meat flocks	355	0	
Turkey, ducks, quale, various other flocks	5	0	
Cattle – surveillance – animals	3 277	0	
Cattle – diagnostics - herds	108	3	*S*. Typhimurium (3)
Sheep – diagnostics - flocks	17	1	*S. diarizonae* (1)
Goats- diagnostics - herds	9	0	
Swine – surveillance – slaughter pigs - animals	1 792	0	
Swine – surveillance – sows - animals	1 394	0	
Swine – surveillance - flocks	87	0	
Swine – diagnostics - flocks	105	0	
Horse – diagnostics - flocks	26	0	
Dogs - diagnostics	296	7	*S*. Typhimurium (3), *S*. Kedougou (2), monophasic *S*. Typhimurium (2)
Cat - diagnostics	59	1	*S*. Typhimurium (1)
Rabbit	3	0	
Alpaca – animals, import	105	0	
Alpaca– flocks - diagnostics	4	0	
Animals/birds/zoo birds/zoos	21	5	All positive were reptiles, 4 different serovars
Various pet birds	6	0	
Various wild animals	26	1	*S. diarizonae* (1 deer)
Wild birds	11	3	*S*. Typhimurium (3)

* Units for numbers are given in the first column.

Table 8. *Salmonella* in food 2015.

Category	Number sampled	Number positive	Comments
Cattle – swab of carcass - surveillance	3 191	0	
Swine - swab of carcass - surveillance	3 186	0	
Meat scrapings (cattle, swine. sheep) - surveillance	3 005	0	
Fish – Norwegian - NIFES	152	0	
Fisk – Imported - NIFES	85	0	
Shellfish- Norwegian - NIFES	46	0	

Table 9. *Salmonella* in feed and feedstuffs 2015.

Category	Number tested*	Number positive	Comments
Feedstuff			
Barley, oats	2	0	
Whete	210	2	
Corn	298 (8)	0	
Rape	313 (2)	0	
Soya	3 014 (9)	0	
Sunflower	102 (1)	9	
Peas etc.	118	0	
Ground nut etc.	141	1	
Other plant based feedstuffs	104	0	
Meat based feedstuff	404	6	
Marine based feedstuff	131	0	
Feed			
Domestic animals (cattle, swine, poultry)	1 000 (29)	0	
Fish	3 628 (86)	23	
Fur animals	216	0	
Environmental samples in factories producing feed and feedstuff	16 192	200	

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

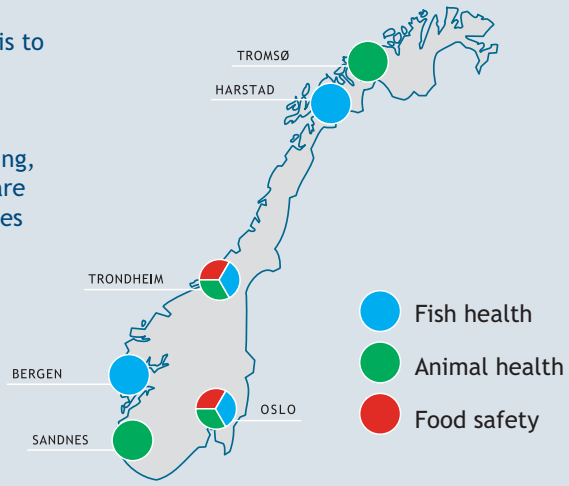
Scientifically ambitious, forward-looking and cooperatively oriented – for integrated health

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

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