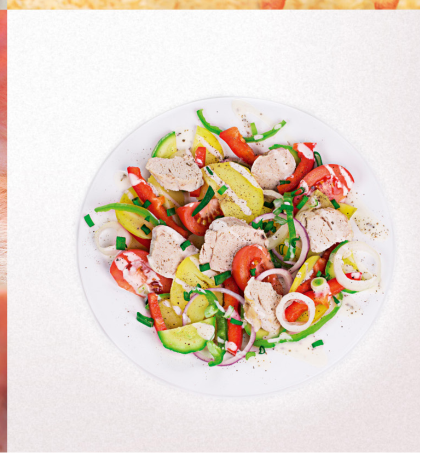
Report 25 - 2019

The Norwegian Zoonoses Report 2018





Veterinærinstituttet
Norwegian Veterinary Institute

The Norwegian Zoonoses Report 2018

Content

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Summary

In general, the occurrence of most zoonoses in 2018 in Norway was similar compared to previous years.

In humans the incidence of zoonotic disease has remained stable; the exception was *E. coli* (VTEC) for which the number of cases has continued to rise. Although the increase observed in recent years can be explained by changes in diagnostic methods, the trend is still of concern 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 Norwegian Food Safety Authority (NFSA) 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 describe trends and detect outbreaks of communicable diseases.

According to the Infectious Disease Control Act, all clinicians and laboratories that analyse samples from humans must report 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 diagnosed infection are classified as "infected in Norway". Patients who develop the diagnosed infection 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 NFSA in cases where humans are believed to be infected from animals or food.

Feed, animals and food
The data presented in this report are obtained through national surveillance programmes, projects, diagnostic investigations and various inspections performed by public authorities and private companies. Two types of data are reported:

- Data on detected notifiable diseases (reported to the NFSA) and data from public surveillance. The NFSA decides which infectious agents are notifiable and which surveillance programmes should be carried out. The NVI assists with planning and laboratory analyses, data processing and reporting. Testing of animals and food for various zoonotic agents is also in association with import and export. In addition, surveillance in association with commercial slaughter through pre-and post-mortem inspections are carried out by the NFSA.
- 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 are obliged to report any detection of notifiable diseases in animals to the NSFA. A large proportion of the laboratory diagnostics (including pathology) performed on animals in Norway is performed by the NVI. In cases where laboratories abroad are used, the responsible veterinarian is obliged to report any detection of notifiable disease in animals. Data from internal control of companies are not always available. One exception is Salmonella-control in feed producing companies, where data from most of the performed internal control is made available and is presented in this report.

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

Preventive and protective measures

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

Humans
When clusters of 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 NSFA is notified.

People employed in the food industry should not work while symptomatic with infections that may be transmitted through food. Before returning to work they should have two negative faecal samples after clinical improvement. For EHEC/VTEC/*S*. Typhi/*S*. Paratyphi/*S. dysenteriae* 1 the number of negative faecal samples should be three.

Feed, animals and food
According to the Food Act (Matloven), Food Business Operators are responsible for implementing appropriate measures to prevent the occurrence or spread of contagious disease in animals, and to notify the NFSA about any suspicion of contagious disease in animals that has potential to cause significant negative consequences for society.

The Regulation on Notification of Diseases in Animals states that veterinarians and laboratories must notify the NFSA about specified 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.
- compromise animal health in an unexpected manner or in an unexpected fashion.

Suspicion or diagnosis of Group A and B diseases in animals should be notified immediately to the Norwegian Food Safety Authority. Diagnosis of group C disease in animals should be reported to the Food Safety Authority within seven working days.

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 efforts 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 NFSA 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 NFSA follows up and inspects the food industry facilities 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 NFSA, the regional offices of the NFSA perform some sampling. However, the data from regional offices are not included in this report.

In total, 14 border inspection posts and 7 associated control centres 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 NFSA must perform further investigations.

Table 1. Disease/agents included in the zoonosis report in 2018 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 (occasionally)
Listeriosis	Yes	No*	Yes (C-disease)	No
Pathogenic *E. coli*	Yes	Yes*	Yes*	No (occasionally)
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 (occasionally)
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

Institute of Marine Research, Geno, Norsvin and the feed industry are acknowledged for providing data for this report.

Salmonellosis

The disease and its transmission routes

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

Surveillance and control

Salmonellosis in humans is notifiable in Norway. From 2017, both *Salmonella* infections verified by PCR and/or by culture are registered in MSIS. *Salmonella*-infection in animals is notifiable (group B-disease). Detection of *Salmonella* in feed or food must also be reported to the NFSA.

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

Results 2018

The number of reported cases of salmonellosis in humans (961) in 2018 was similar to the last four years (Figure 1). Information on the most frequently detected serotypes is presented in the Appendix.

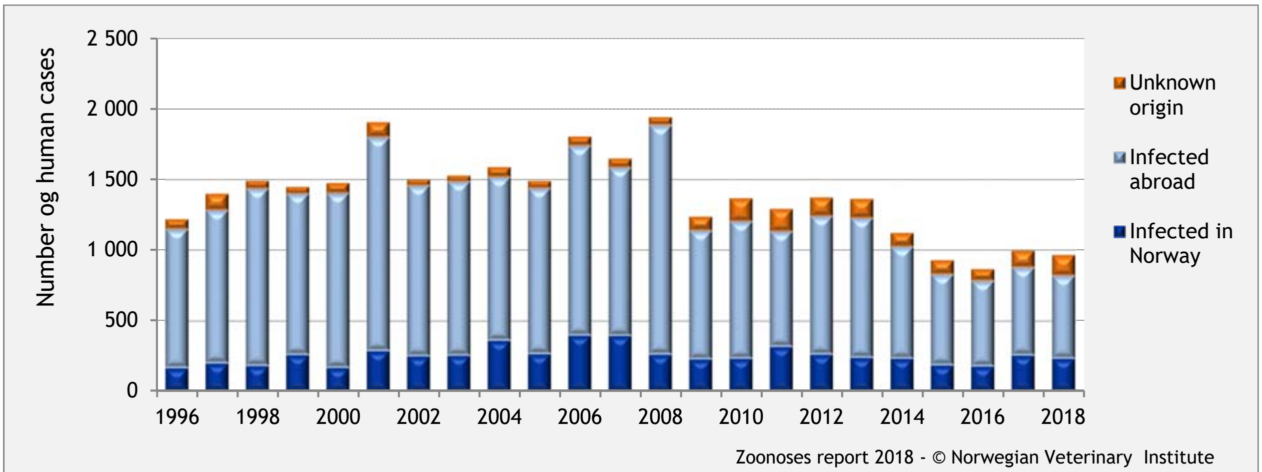

Figure 1. Reported cases of salmonellosis in humans. Data from MSIS.

Three *Salmonella* positive poultry flocks were identified through the surveillance programme. These included two layer flocks and one flock of geese. *Salmonella* was also detected in lymph node samples from three slaughter pigs and three cattle (Figure 2).

A large outbreak of salmonellosis in horses occurred in Norway 2018, with 66 horses in 23 localities positive for a monophasic *Salmonella* Typhimurium. More than 3,000 samples from horses, their environment, feed and other contact animals of other species were collected during the outbreak, from about 130 different localities. The first case was detected in an equine hospital in June 2018. Very few of the salmonella-positive horses displayed clinical symptoms of salmonellosis. The same *Salmonella*-strain was also detected in a sheep flock and a cattle herd with an epidemiological link to an infected horse.

In 2018, only a few cases of salmonellosis were diagnosed in cats (n=2) and dogs (n=3), but out of 21 samples from reptiles, 19 samples were positive for *Salmonella*. Details on *Salmonella* testing of feed, animals and food are shown in the Appendix.

Evaluation of the current situation

The number of salmonellosis cases in humans has gone down over the past 10 years, but the number of cases infected in Norway has remained relatively stable with an incidence of 3.6 to 4.8 in the last 5 years. More than 60% of infected humans were reported 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 (Figure 2). *Salmonella diarizonae* is occasionally detected in Norwegian sheep. This variant is only rarely associated with disease in animals, and is not considered a public health threat.

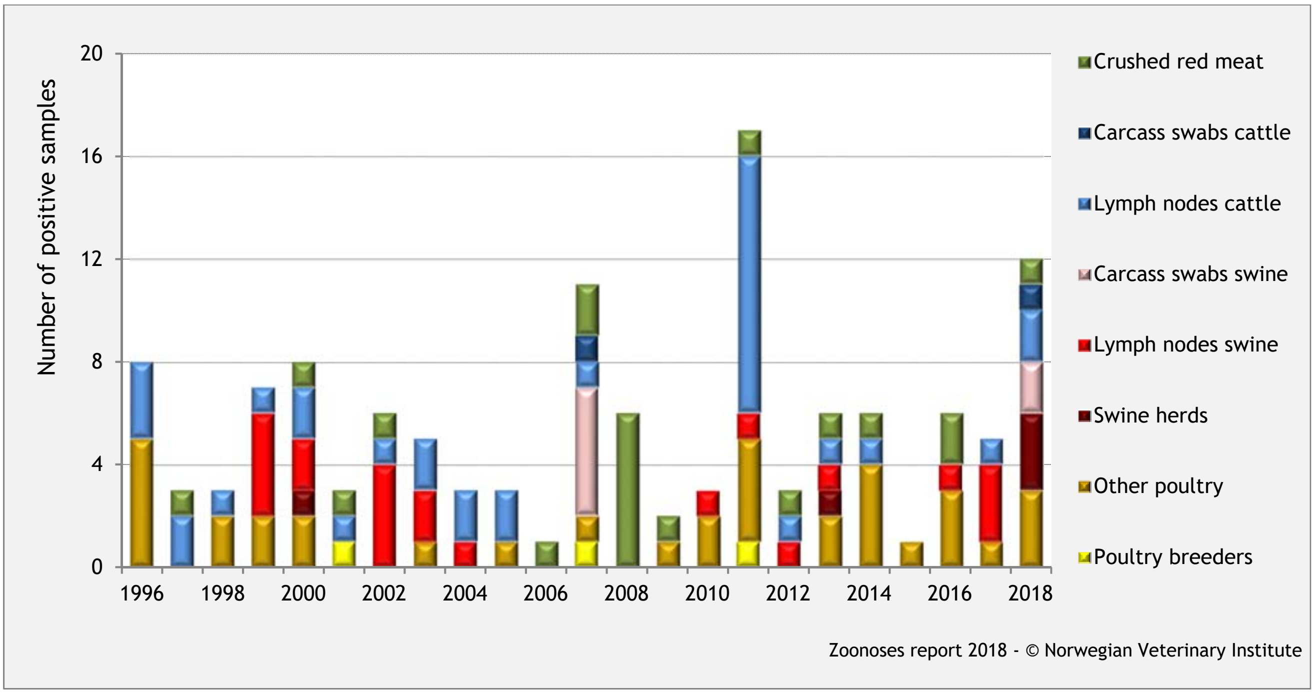

Figure 2. The number of positive samples in the *Salmonella* surveillance programme.

Salmonella is occasionally detected in dogs and cats and in reptiles in Norway, but the number of detected cases in dogs and cats has decreased slightly in the last few years. Only a few cases are detected annually in the diagnostic services at the NVI, and only a few cases are reported to the Food Safety Authority. In Sweden, the number of cases of Salmonella in cats was almost 1200 in 2018 (report SVA). The reasons for the large difference in occurrence of *Salmonella* infections in Swedish *versus* Norwegian cats are not known.

In 2017, an exemption was made for 19 species on the general ban on import and marketing of reptiles in Norway. Reptiles frequently carry *Salmonella* and may pose a source of infection to humans. In 2018, 21 samples from reptiles were analysed for Salmonella at the NVI and 19 of them were positive.

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 generally free from *Salmonella* in Norway, 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 disease and its transmission routes
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, both campylobacter infections verified by PCR and/or 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 2018

In MSIS, 3,669 human cases of campylobacteriosis were reported, of which 1,215 contracted the infection in Norway. For 626 of the cases place of infection was unknown. This is at the same level as the number of cases reported last year. Before 2017, cases verified only by PCR were not reported. From 2017, all cases verified by PCR and/or culture are registered in MSIS and reported. However, when the total number of positive cases for 2017 and 2018 are compared to positive cases verified by both culturing and/or PCR in 2015 and 2016, the numbers for each year are similar, suggesting that there has not been an increase in the occurrence of campylobacteriosis in Norway (Figure 3).

Surveillance in 2018 showed that a total of 126 flocks (6.3%) tested positive for *Campylobacter* spp. when all broiler flocks slaughtered before 51 days of age during the period May – October were tested. In total 1,986 flocks from 510 farms were sampled. Of the positive flocks, 39.7% originated from 22 (4.3%) of the farms and 19.2% (98) of the farms delivered at least one *Campylobacte*r-positive broiler flock. The result is quite similar to 2017.

In the diagnostic services at the NVI, *Campylobacter* was detected in samples from 13 cattle, 31 dogs and one cat. For details see the Appendix.

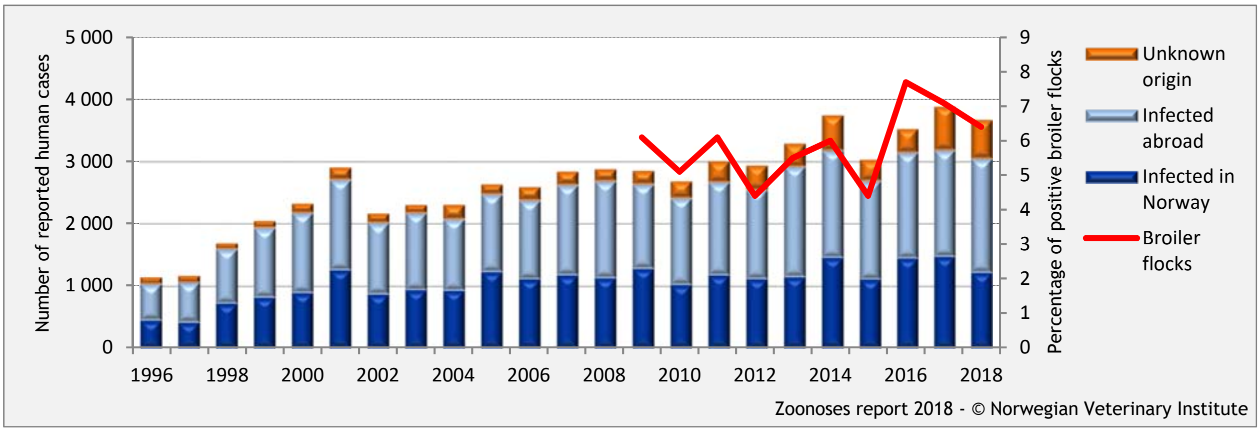

Figure 3. The number of reported cases of campylobacteriosis in humans (data from MSIS) and the percentage of positive broiler flocks (sampled between 1st May and 31st October).

Evaluation of the current situation

Campylobacteriosis is the most commonly reported zoonosis in humans in Norway. More than half of the cases are reported as infected abroad.

Case-control studies have shown that the most common source of campylobacteriosis in Norway is drinking untreated water at home, at holiday homes or in nature. Eating or preparing poultry and barbeque meals have also been identified as risk factors for infection. No studies have demonstrated a link between eating beef or lamb and campylobacteriosis 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 *Campylobact*er 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 (3-7% 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. A few farms seem to deliver a high proportion of the positive flocks.

Yersiniosis

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

Yersinia pseudotuberculosis 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* and *Y. pseudotuberculosis* in animals are 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 2018

The number of reported cases of yersiniosis (105) increased slightly compared to the last few years (Figure 4). All reported cases in 2018 were caused by *Yersinia enterocolitica*.

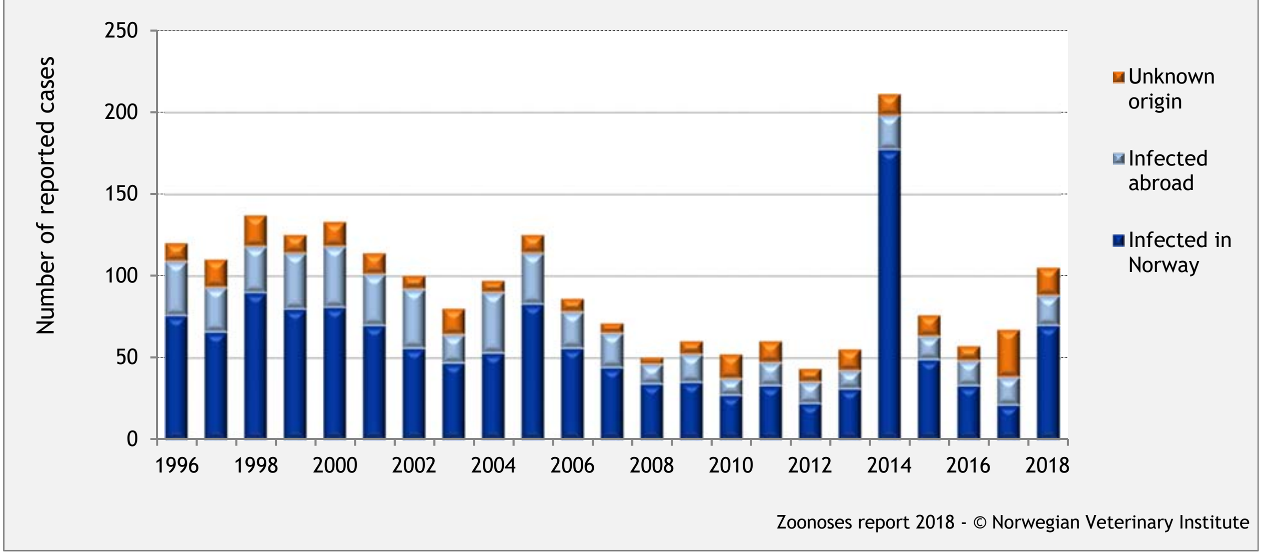

Figure 4. The number of reported cases of yersiniosis in humans. Data from MSIS.

In the diagnostic services at the NVI, *Y. enterocolitica* was detected in one sheep.

Evaluation of the current situation

Most yersiniosis cases in humans in Norway are sporadic and 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 and the civilian population. In 2018, two outbreaks were reported, one with six cases due to *Y. enterocolitica* O:3, and one larger outbreak with 20 cases due to *Y. enterocolitica* O:9. Ready to eat salad was suspected to be the source of the second outbreak.

Y. 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 disease and its transmission routes
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 are 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 corrective action must be taken to avoid further contamination. Dietary advice is available for persons in risk groups; www.matportalen.no and www.fhi.no

Results 2018

Twenty-four cases of listeriosis were reported in humans in 2018 (Figure 5). The number of cases increased slightly in 2018 compared to the three previous years. This is probably due to an outbreak of listeriosis with 13 confirmed cases. Epidemiological and microbiological studies showed that “rakfisk”, a fermented fish product, was the cause of the outbreak.

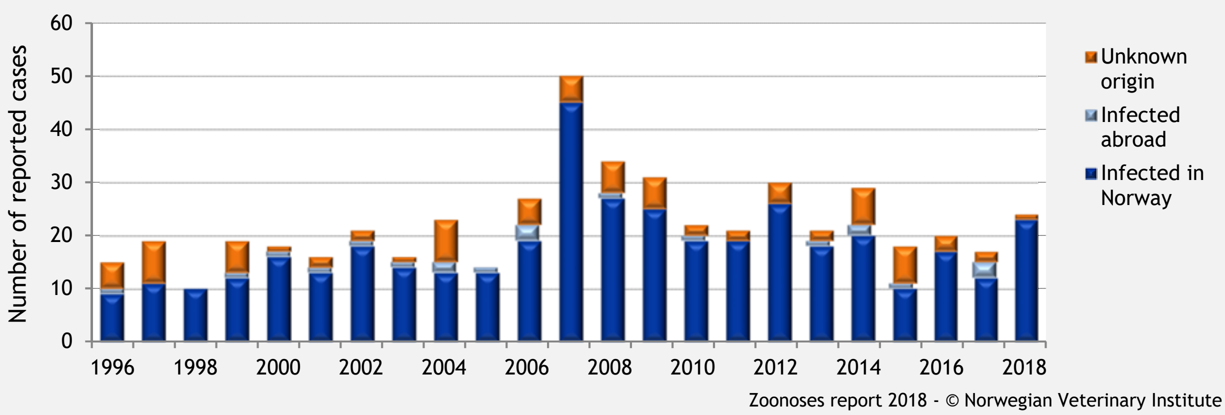

Figure 5. The number of cases of listeriosis in humans. Data from MSIS.

The Institute of Marine Research (Havforskningsinstituttet) examined 97 samples of seafood for *L. monocytogenes* and two samples of imported fish products were positive, but had less than 100 cfu/g. At the NVI, *L. monocytogenes* were detected in diagnostic samples from one cow and six sheep.

Evaluation of the current situation

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

Verotoxin producing *E. coli* (VTEC)

The disease and its transmission routes
Escherichia coli are normal inhabitants of the intestines of humans and animals. Some *E. coli* can produce verotoxin (also called shigatoxin). These variants are called verotoxin (VTEC) or shigatoxin (STEC) producing *E.coli*, and can cause serious disease and bloody diarrhoea in humans (hence the term EHEC - enterohaemorrhagic *E. coli*). Transmission occur via food, water or by animal contact.

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

VTEC 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.

Results 2018

The number of reported EHEC cases in humans (n=494) continues to increase (Figure 6), but the number of cases developing HUS remains low (2-8 cases/year). At least 50% of the cases in 2018 were diagnosed with low-virulent VTEC.

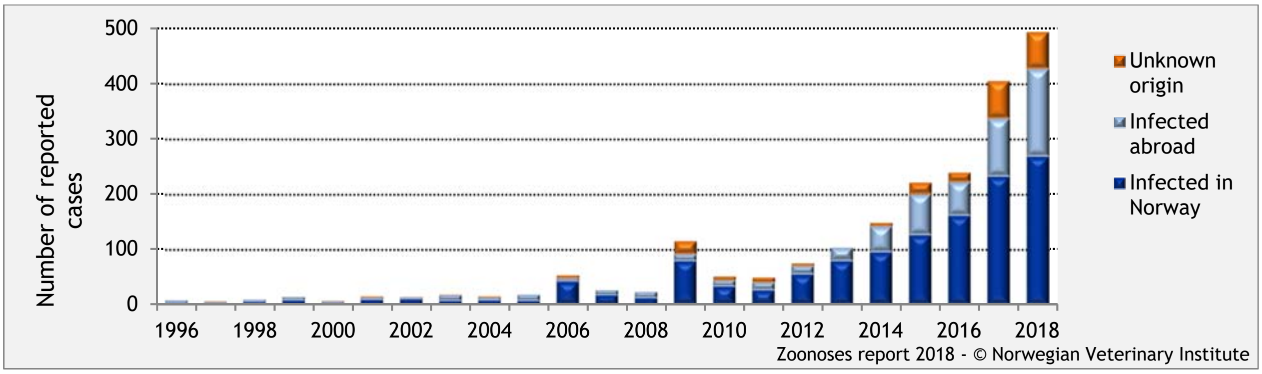

Figure 6. The number of reported cases of EHEC (enterohaemorrhagic *E. coli*) in humans. Data from MSIS.

During the investigation of four sporadic human EHEC infections in 2018, eight samples were collected, primarily different meat products, but also water and faecal samples were analysed. Shiga toxin-producing *E. coli* were not isolated from any of the samples.

Evaluation of the current situation

The occurrence of EHEC-infections reported in humans has been increasing since 2012. More than half of the cases have been infected in Norway. The increase is most likely associated with the introduction of culture independent diagnostics (PCR) as a routine in primary diagnostics and the fact that more patients than before are investigated for EHEC. Several major medical microbiological laboratories investigate all submitted faecal specimens for several different pathogens, including EHEC. Previously, analysis for EHEC was only performed based on defined clinical or epidemiological indications.

In a survey of zoonotic *E. coli* in Norwegian cattle, conducted in 2014, the Norwegian Veterinary Institute found a low occurrence of STEC, with 15.6% % of 179 herds positive for at least one STEC belonging to six serogroups (O26, O91, O103, O121, O145 and O157).

Tuberculosis

The disease and its transmission routes
Tuberculosis is caused by species in the *Mycobacterium tuberculosis*-complex. 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 where Norway is declared as officially free. 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 NFSA have a surveillance program for *M. tuberculosis* in cattle, camelids and farmed deer.

Results 2018

In total, 167 cases of tuberculosis in humans were reported in 2018. None of these were caused by *M. bovis*.

All cattle, sheep, goats, swine and horses commercially slaughtered were examined *post mortem*. In addition, 122 breeding pigs and 132 breeding bulls were tuberculin tested, and all were negative. As part of diagnostic testing, samples from nine pigs, four alpaca and one llama were tested for mycobacteria. Eight of the samples from pigs were positive for *M. avium* subsp. *hominissuis*. These bacteria may cause tuberculous lesions, but do not cause contagious disease. Remaining samples were negative for mycobacteria. For details see the Appendix.

Evaluation of the current situation

M. bovis infection in humans is rarely reported in Norway. Less than 1% of the reported human tuberculosis cases in the last 10 years were caused by *M. bovis,* and these patients were either infected abroad or many decades ago in Norway. Since the mid-1990s, the number of tuberculosis cases caused by *M. tuberculosis* has increased in Norway due to immigration, but for the last 4 years (since 2013) the number has decreased.

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 to Norway, especially camelids like llama and alpaca, is associated with a risk of introducing *M. bovis* to the Norwegian animal population. Foreign farm labourers could represent a potential, but low risk of introducing *M. bovis* and *M. tuberculosis* to Norwegian animals.

Brucellosis

The disease and its transmission routes
Brucellosis is caused by *Brucella* bacteria, of which *B. abortus* (cattle), *B. melitensis* (sheep), and *B. suis* (pigs) are the most important zoonotic species. *B. canis,* which causes disease in dogs, is less pathogenic for 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 notifiable group A-disease.

The surveillance program for *Brucella* includes blood tests from cattle that have aborted and annual blood testing of a sample 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 2018

Three cases of brucellosis in humans were reported in 2018. All three were infected abroad.

As part of the surveillance programmes, 139 cattle from 56 herds, 8,636 sheep from 3,267 flocks, and 1,691 goats from 61 herds were tested. Antibodies against *Brucella* spp. were not detected. In addition, 1,923 swine, 301 cattle, 23 alpaca, and 53 dogs were tested for various other reasons. One of the 53 dogs was tested for *B. canis* in association with clinical suspicion and was negative. Eleven dogs were tested for *B. canis* antibodies in association with export, and 41 dogs were tested in a surveillance programme for imported dogs. *B. canis* antibodies were not detected in any of these samples. For details see the Appendix.

Evaluation of the current situation

In humans, brucellosis 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 by 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.*

Results 2018

No cases of trichinellosis were reported in humans in 2018.

All commercially slaughtered pigs and horses were tested for *Trichinella,* and none were positive. The NVI also recommend that all hunted wild boar are tested for *Trichinella* before consumption. *Trichinella* testing of wild boar meat was included in a wild boar health surveillance project during 2018. Samples from 15 wild boar were analysed at Statens Veterinärmedisinska Anstalt (SVA) in Sweden, and all were negative. 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.

Trichinella 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 definitive 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 entering Norway must be treated for *Echinococcus* before arrival. Regular anti-parasitic treatment of dogs is also recommended in areas with reindeer.

Results 2018

Seven cases of echinococcosis in humans were reported in 2018, and all had contracted the infection abroad.

In the surveillance program for *E. multilocularis*, 537 foxes and 31 wolves were examined, and *E. multilocularis* was not detected in any of them. 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 7 cases have been reported annually of which 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 mainland Norway. However, it is detected in Sweden, and surveillance of red foxes has been intensified in Norway in order to rapidly detect the parasite should it be introduced to Norway. Since 2002, 5,037 red foxes have been tested, and all were negative.

E. multilocularis is endemic in Svalbard in sibling vole (*Microtus levis*) and the Arctic fox (*Vulpes lagopus*). Dogs and people in Svalbard are therefore at risk.

It is essential that dog owners follow regulations on antiparasitic therapy when entering Norway from abroad. Echinococcosis occurs in dogs in southern Europe, and the infection may be introduced to the Norwegian population of intermediate and definitive hosts via untreated, imported dogs or dogs returning with their owners after holidays abroad.

Toxoplasmosis

The disease and its transmission routes
Toxoplasma gondii is a single celled parasite that has its adult stage in the cat (definitive 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 NFSA provides dietary advice to persons in risk groups (www.matportalen.no). Every year some animals are tested for *T. gondii* due to disease, abortion or in association with import/export. Testing of cats for *T. gondii* is not considered necessary.

Results 2018

As part of the diagnostic work at the NVI, nine sheep and one arctic fox were tested serologically for *T. gondii.* One sheep and the arctic fox 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 in 1,000 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 4,300 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-serum to treat people who may have been exposed to 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 required 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 required.

Results 2018

Rabies was not detected in humans in Norway in 2018.

Four dogs from mainland Norway, and 19 arctic foxes (from Svalbard), six Svalbard reindeer and a polar bear (from Svalbard) were tested for rabies at the NVI. Rabies infection was detected in four arctic fox and one Svalbard reindeer. Rabies was not detected in any. 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 a ringed seal in Svalbard. The last detection was in 2011-2012 and before that 1999. Hence, outbreaks of rabies occur sporadically in Svalbard, most probably due to migrating arctic foxes during winter. It is important that persons living in or traveling to Svalbard are aware that rabies may occur among wild animals and take necessary precautions.

Dogs imported to Norway without vaccination may confer a risk of introducing rabies to mainland Norway. In a study performed at the NVI in 2012, serological results indicated that approximately 50% of dogs imported from Eastern Europe were improperly vaccinated or not vaccinated at all. 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, humans and other animals may also 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 NFSA may impose restrictions on animal holdings where infection is confirmed or suspected.

From 2012, samples collected in the surveillance programme for *Brucella abortus* in cattle have also been tested serologically for *C. burnetii*. The programme involves passive clinical surveillance, and blood samples from cattle with an abortion in the second half of the pregnancy are analysed.

Results 2018

Five cases of Q-fever in humans were reported in 2018. All five had contracted the infection abroad.

At the NVI, blood samples from a total of 250 cattle, 13 sheep, 75 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 is not currently a problem for human or animal health in Norway. The infection became notifiable in humans in 2012, and since then 17 cases have been reported in total. Of these, 16 cases were infected abroad and one case had an unknown place of infection.

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 (3,289 bovine dairy herds). Since then, testing has been performed on imported animals and as part of diagnostic testing of sick animals.

BSE and vCJD

The disease and its transmission routes
Bovine spongiform encephalopathy (BSE, mad cow disease) in cattle and Creutzfeldt-Jacob disease (CJD) in humans are transmissible spongiform encephalopathies (TSE). These fatal diseases cause spongy degeneration of the brain and spinal cord. The infective agents are prions, protein structures without DNA. A form of CJD, variant CJD (vCJD) 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 CJD 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 defined clinical signs at slaughter and a sample of routinely 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 in 1990.

Results 2018

No cases of sporadic vCJD were reported in humans in 2018.

In total, 6,327 cattle were tested, and all were negative for BSE.

Evaluation of the current situation

The situation with respect to classic BSE is favourable in Norway, largely due to restricted and controlled import of live animals, meat and bone meal in the past when the disease emerged and spread in Europe, and historical strict regulations on heat treatment and use of meat and bone meal.

The first and only case of BSE in cattle in Norway, an atypical BSE case - and as such not a zoonosis, was detected in 2015.

Antimicrobial resistance

Infections with antimicrobial resistant bacteria can be difficult to treat. Resistant bacteria may be zoonotic and transmit through direct or indirect contact, including through food. One example of this 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 and carriage of MRSA in humans is notifiable in Norway. In addition, selected microbes from certain infections, and their resistance profiles, are reported annually to the NORM surveillance programme for antimicrobial resistance in human pathogens.

In 2000, Norway implemented a surveillance programme for antimicrobial resistance in pathogens from animals, feed and food (NORM-VET). In 2013, a separate surveillance program for MRSA in swine was established. Norway has chosen a strategy to eradicate MRSA from swine, and therefore detection of MRSA in any production animal is reported to the NFSA.

Results 2018

The prevalence of antibiotic resistant bacteria is still low in both humans and animals in Norway compared to other European countries. Details on detection of selected pathogens in humans and animals and their antimicrobial resistance profiles are presented in the annual NORM/NORM-VET report (https://www.vetinst.no/overvaking/antibiotikaresistens-norm-vet).

The surveillance programme in 2018 did not detect any pig herds with MRSA. In total, 716 herds were included in the survey, of which 86 were genetic nucleus or multiplier herds, 12 herds were central units of the sow pool herds, 19 were of the largest farrow to grower or farrow to finish herds, and 599 were finishing pig herds.

In 2018, 18 *Salmonella* spp. isolates from animals were susceptibility tested including isolates from three dogs, five cats, three cattle and one pig and one geese. Nine of the isolates were fully susceptible to all substances tested for. Three of the four remaining isolates were resistant to a total of six of the tested antimicrobials. These three were obtained in connection to a *Salmonella* outbreak in horses.

Campylobacter jejuni from broilers and turkey were retrieved from flocks that had tested positive in the *Campylobacter* surveillance programme. The results indicate a low occurrence of resistance among the *Campylobacter jejuni* isolates from both broilers and turkey.

Evaluation of the current situation

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

Resistant pathogens may spread through healthy carriers. MRSA was most likely first introduced to Norwegian swine production through foreign labourers carrying the bacteria, and subsequently spread further through movement of live animals. From swine, MRSA may transmit back to humans through direct or indirect contact. This form of transmission 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 cases of a disease with a common source of infection. In 2005, the NIPH and the NFSA introduced a web-based system for reporting outbreaks, Vesuv. The system is used by specialist- and municipal health services and the NFSA to notify outbreaks. The following types of outbreaks are notifiable through Vesuv: outbreaks of conditions that are notifiable in MSIS; outbreaks associated with food or water; outbreaks caused by particularly serious infections; very large outbreaks; and outbreaks in healthcare institutions. The four last categories also include outbreaks of conditions that are not notifiable in MSIS.

The purpose of investigating foodborne outbreaks is to stop the outbreak, implement control measures and prevent future outbreaks. The District Medical Officer is responsible for coordinating investigation and response to outbreaks in his/her municipality. Proper outbreak investigation requires cooperation between local and central health authorities, the NFSA and other relevant authorities.

Results 2018

In 2018, the NIPH received 52 notifications through Vesuv of possible or confirmed foodborne outbreaks outside health institutions. In total, 1,109 persons were reported to have become sick in these outbreaks. The number of affected persons in each of the outbreaks varied between 2 and 148 (median 13). The most common infective agent was Norovirus (17 outbreaks) followed by enterohaemorrhagic *E. coli* (EHEC) and *Salmonella* (4 outbreaks each). In 17 of the outbreaks, the causative agent was not identified (Figure 7).

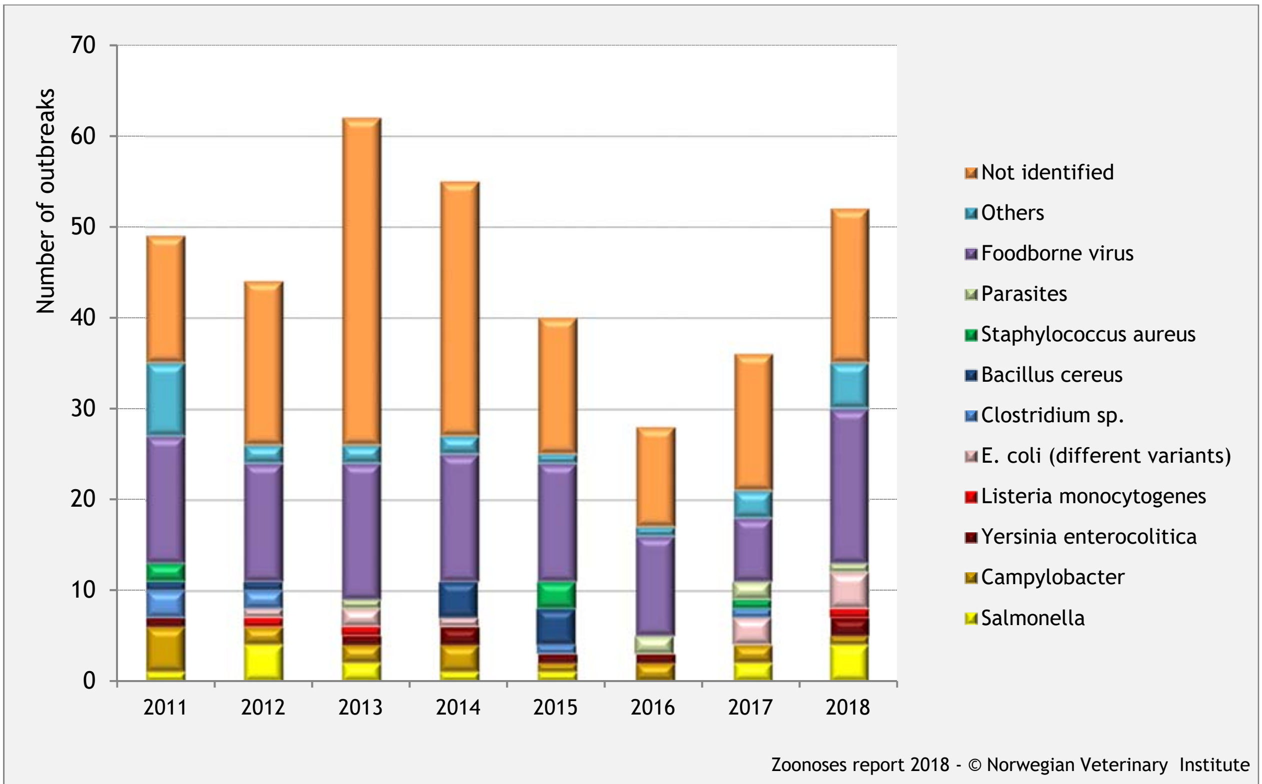

Figure.7. The number of reported foodborne outbreaks where an agent was verified or strongly suspected.

Appendix Tables 2018

Table 1. Human population of Norway per 1st January 2018 (from statistics Norway).

Age group	Female	Male	Total
0 - 9	303 138	320 113	623 251
10 - 19	309 871	327 771	637 403
20 – 29	347 413	366 532	713 945
30 – 39	344 395	363 989	708 384
40 – 49	357 670	377 398	735 068
50 – 59	332 246	348 479	680 725
60 – 69	285 657	286 665	572 322
70 – 79	209 158	192 372	401 530
80 – 89	105 795	72 265	178 060
90 -	31 905	12 787	44 692
Total	**2 627 248**	**2 668 371**	**5 295 619**

Table 2. Animal population of Norway in 2018.

Animal species - category	Number*		
	Herds /flocks	Animals	Slaughtered animals
Cattle - total	13 700[a]	992 000[a]	318 000[b]
Dairy production	8 200[a]	218 000[a]	
Meat production	5 800[a]	90 900[a]	
Other stock	13 600[a]	683 000[a]	
Sheep - total	14 300[a]	2 000 000[a]	1 313 000[b]
Sheep >1 year	14 300[a]	1 006 000[a]	231 000[b]
Goats - total	1 200[a]	69 600[a]	24 500[b]
Dairy goats	340[a]	35 500[a]	
Swine - total	2 100[a]	795 000[a]	1 699 000[b]
Breeding pigs	1 100[a]	49 400[a]	68 700[b]
Slaughter pigs	1 900[a]	443 000[a]	1 631 000[b]
Chickens (*Gallus gallus*)			
Grandparent stock – egg producers	3 (5)[c1]		
Parent stock – egg producers	7 (13)[c1]		
Parent stock – broiler	92 (133)[c1]		
Laying hens	562 (847)[c]		504 000[b]
Broilers	656 (4 221)[c]		62 739 000[b]
Turkey, goose and duck			1 100 000[b]
Parent stock	6 (15)[c1]		
Meat production	59 (193)[c]		
Horse	4 500[a]	24 100[a]	201[b]
Reared deer	96[a]	6 350[a]	

* 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 01.03.2018, Norwegian Agricultural Agency.
[b] Figures from the Norwegian Agriculture Agency (based on delivery for slaughter).
[c] Figures from the surveillance programme for Salmonella.
[1] Production flocks only.

Table 3. The most common *Salmonella* serovars found in humans in Norway in 2018.

Serovar	Place of infection			Total
	Norway	Abroad	Unknown	
S. Enteritidis	61	44	143	248
S. Typhimurium	27	8	36	71
S. Typhimurium monophasic variant	22	14	31	67
S. Stanley	16	8	27	51
S. Newport	11	5	14	30
S. Java	3	1	13	17
S. Saintpaul	0	2	8	10
S. Agona	2	2	5	9
S. Virchow	3	1	5	9
S. Corvallis	3	0	4	7
S. Infantis	0	1	6	7
S. Kentucky	1	0	6	7
Others	81	58	289	428
Total	230	144	587	961

Table 4. Human cases of campylobacteriosis (infected in Norway) in 2018 distributed by county. From 2017 both cases verified by PCR and/or culturing are notifiable to MSIS and included in the table. PCR positive cases are also included for 2015 and 2016.

County	2011	2012	2013	2014	2015	2016	2017	2018
Akershus	91	108	120	157	123	142	127	94
Aust-Agder	18	20	14	33	14	23	29	12
Buskerud	48	63	60	65	63	68	83	56
Finnmark	13	6	6	19	12	21	19	21
Hedmark	39	28	51	54	42	58	56	32
Hordaland	136	128	115	156	122	148	185	163
Møre og Romsdal	54	36	47	73	34	35	71	59
Nordland	47	31	46	60	47	42	44	57
Nord-Trøndelag	28	31	29	34	27	42	33	
Oppland	69	68	62	76	57	66	96	81
Oslo (f)	113	136	103	154	120	109	109	144
Rogaland	177	124	169	130	124	166	205	129
Sogn og Fjordane	45	24	27	27	26	20	31	25
Sør-Trøndelag	85	115	95	117	94	98	116	
Telemark	37	39	34	50	35	55	46	32
Troms	25	20	23	55	43	57	52	35
Trøndelag								118
Vest-Agder	45	34	41	54	33	40	48	32
Vestfold	42	51	42	79	48	186	101	76
Østfold	63	52	66	71	44	73	61	49
Total	**1 175**	**1 114**	**1 150**	**1 464**	**1 108**	**1 449**	**1 512**	**1 215**

Table 5. Foodborne outbreaks.

Agent	2011	2012	2013	2014	2015	2016	2017	2018
Salmonella sp.	1	4	2	1	1		2	4
Campylobacter sp.	5	2	2	3	1	2	3	1
Yersinia sp.	1		1	2	1	1	1	2
Listeria monocytogenes		1	1					1
Escherichia coli (VTEC)		1	2	1		1	3	4
Clostridium sp.	3	2			1		1	
Bacillus cereus	1	1		4	4			
Staphylococcus enterotoxin	2				3		1	
Parasites			1			2	2	1
Virus	14	13	15	14	13	11	7	17
Other	8	2	2	2	1	1	1	5
Unknown	14	18	36	28	15	11	15	17
Total	**49**	**44**	**62**	**55**	**40**	**29**	**36**	**52**

Table 6. *Salmonella* in feed and feedstuff 2018.

Category	Number tested*	Number positive	Comment
Feedstuff			
Cereal grain	23	2	*S.* Molade, *S.* Muenster
Corn	38	0	
Rape	105	0	
Soya	2 771	2	*S.* Mbandaka
Sunflower	12	0	
Legume seeds etc.	30	2	*S.* Agona
Tubers, roots etc.	12	0	
Other plant based feedstuffs	15 (9)	2	*S.* Molade, *S.* Lexington
Meat based feedstuff	404	7	*S.* Rissen (1), *S.* Havana (6)
Marine based feedstuff	35	0	
Feed			
Domestic animals (cattle, swine, poultry)	53 (78)	0	
Fish	3 273 (76)	3	*S.* Agona (1), *Salmonella* sp. (2)
Fur animals	130	1	*Salmonella* sp.
Environmental samples in factories producing feed and feedstuff	18 581	176	31 different serovars

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

Table 7. *Salmonella* in animals 2018.

Category	Number* tested	Number* positive	Comment
Chicken – surveillance - breeding flocks	151	0	
Chicken – surveillance – layer flocks	847	2	*S. diarizonae*
Chickens – surveillance – broiler flocks	4 221	0	
Chicken flocks – other samples	36	0	
Turkey, ducks, geese – surveillance - breeding flocks	15	0	
Turkey, ducks, geese – surveillance – meat flocks	193	1	*S.* Typhimurium
Turkey, ducks, geese – other samples	8	0	
Cattle – surveillance – animals	3 194	2	*S.* Typhimurium
Cattle – diagnostics - herds	79	3	*S.* Typhimurium (2), *S.* Typhimurium monophasic (1)
Sheep – diagnostics - herds	23	7	*S. diarizonae* (6), *S.* Typhimurium monophasic (1)
Goats- diagnostics - herds	5	0	
Swine - surveillance – slaughter pigs - animals	1 688	3	*S. diarizonae* (2) *S.* Leeuwarden (1)
Swine - surveillance – sows - animals	1 436	0	
Swine - surveillance – breeding herds	83	0	
Swine - diagnostics - herds	34	3	*S.* Kedougou
Horse - diagnostics – animals	1 275	66	*S.* Typhimurium monophasic (65) *S.* Typhimurium (1)
Dogs - diagnostics	180	3	*S.* Agona (1), *S.* Typhimurium (1), *S.* Typhimurium monophasic (1)
Cat - diagnostics	47	2	*S.* Typhimurium
Alpaca – animals, import	59	0	
Alpaca- herds - diagnostics	3	0	
Wild boar – surveillance - animals	15	1	*S.* Typhimurium
Animals/birds/zoo birds/zoos	23	0	
Reptiles**	21	19	*S.* Tennessee (9), *S.* diarizonae (3), *S.* salamae (2), *S.* arizonae (2), *S.* Adelaide (1), *S.* Havana (1), *S.* Hadar (1), *S.* Mapo (1), *S.* Istanbul (1), *S.* Fluntern (1)
Various wild animals	17	1	*S.* Enteritidis
Wild birds	12	0	

* Units for numbers are given in the first column.
** Four different serotypes were isolated from one reptile.

Table 8. *Salmonella* in food 2018.

Category	Number sampled	Number positive	Comment
Cattle – swab of carcass - surveillance	3 100	1	*S. diarizonae*
Swine - swab of carcass - surveillance	3 198	2	*S.* Kedougou, *S. diarizonae*
Meat scrapings (cattle, swine. sheep) - surveillance	3 052	1	*S. diarizonae*
Fish – Norwegian – IMR*	40	0	
Fish – Imported – IMR*	95	0	
Shellfish - Norwegian – IMR*	21	0	

* Institute of Marine Research (Havforskningsinstituttet)

Table 9. Selected zoonoses in animals in 2018. *Salmonella* is presented in separate tables.

Infection/agent	Category	Number tested	Number positive	Comment
Campylobacteriosis	Broiler chicken flocks - surveillance	1 986	126	May - October
	Cattle - diagnostics	81	13	*C. jejuni* (12), *C.* sp. (1)
	Sheep - diagnostics	13	0	
	Goat - diagnostics	3	0	
	Swine - diagnostics	15	0	
	Horse - diagnostics	1	0	
	Dog - diagnostics	97	31	*C. upsaliensis* (26), *C. jejuni* (4), *C.* sp.(1),
	Cat - diagnostics	16	1	*C. jejuni*
Tuberculosis	Cattle – tuberculin testing	132	0	
	Swine – tuberculin testing	122	0	
	Swine - diagnostics	9	8	*M. avium* subsp. *hominissuis*
	Alpaca – surveillance	4	0	
	Lama - surveillance	1	0	
Brucellosis	Cattle - surveillance	139	0	
	Cattle – breeding animals, export	301	0	
	Sheep – surveillance	8 636	0	
	Goat - surveillance	1 691	0	
	Swine – breeding stock	1 923	0	
	Dog	53	0	Suspicion of disease (1), export (11), surveillance (41)
	Alpaca - import	23	0	
Echinococcosis	Fox - surveillance	537	0	
	Wolf - surveillance	31	0	
	Cattle, small ruminants, swine, horse	All slaughtered*	0	
Toxoplasmosis	Sheep - diagnostics	9	1	
	Arctic fox - diagnostics	1	1	
Rabies	Dog – diagnostics	4	0	
	Arctic fox - diagnostic	19	4	
	Svalbard reindeer - diagnostic	6	1	
	Polar bear - diagnostic	1	0	
Trichinellosis	Pig and horse	All slaughtered*		
Q-fever	Cattle - surveillance	153	0	
	Cattle - diagnostic	97	0	
	Sheep - import	13	0	
	Alpaca – import	75	0	
BSE	Cattle	6 327	0	

* Commercial slaughter (for animal population see Table 2.).

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.

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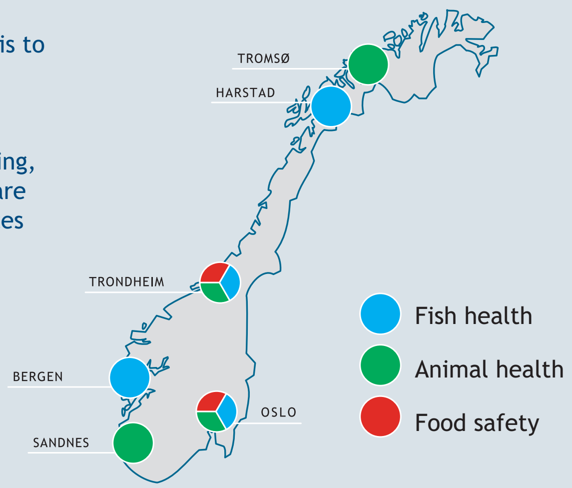

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