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The Norwegian Zoonoses Report 2020

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Content

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Summary

The occurrence of most zoonotic pathogens in animals was stable in 2020 compared to previous years. The occurrence in humans, however, decreased in 2020 due to the COVID-19 situation. The decrease was highest in campylobacteriosis, salmonellosis and *E. coli* (EHEC/VTEC) infections, mainly due to less travel associated cases.

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:
https://www.efsa.europa.eu/en/efsajournal/pub/6971

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 72 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 travel associated and "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, NFSA is notified and an outbreak investigation team consisting of NFSA, NVI, relevant municipal doctors and NIPH is established.

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 Enterhaemorhagic *Escherichia coli* (EHEC/VTEC), *Salmonella* Typhi, S. Paratyphi and Shigella *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 head 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 2020 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 slaughtered before 51 days of age between May and October, 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 2020

The number of reported cases of salmonellosis in humans (440) decreased in 2020 compared to the previous four years (Figure 1). Information on the most frequently detected serotypes is presented in the Appendix.

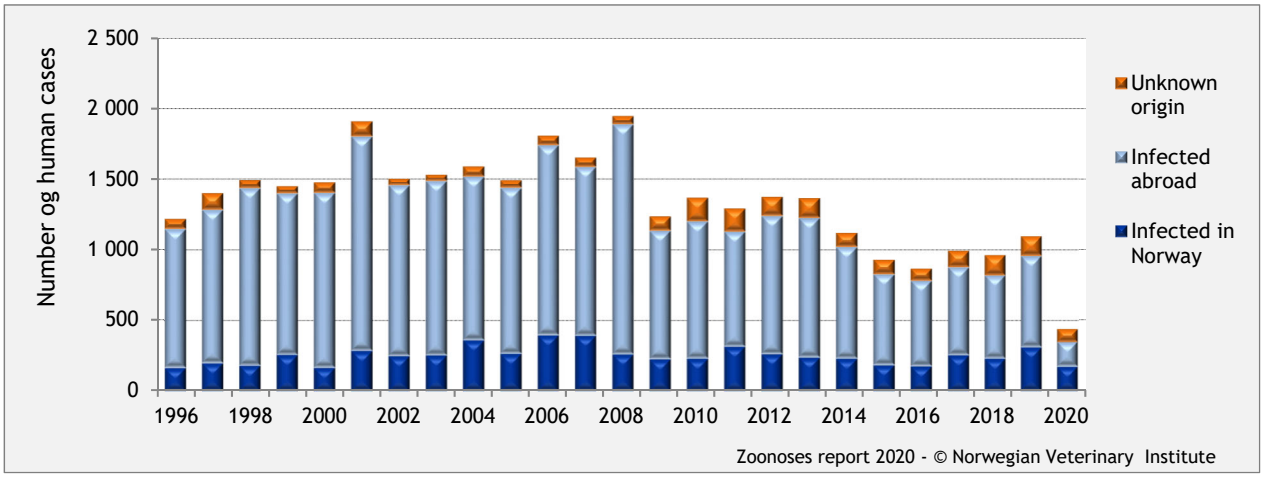


Figure 1. Reported cases of salmonellosis in humans. Data from MSIS.

The surveillance programme for *Salmonella* includes testing of live animals (pigs, poultry and cattle) and fresh meat (pigs and cattle). From altogether 8,882 faecal samples in 1,342 poultry holdings one broiler flock was positive for *Salmonella*, giving an estimated *Salmonella* prevalence of 0.02% in poultry flocks for slaughter. *Salmonella* was not detected in 1,496 faecal samples from 78 elite and multiplier breeding swine herds, but one of 3,245 lymph node samples from slaughter pigs was positive for *Salmonella* giving an estimated *Salmonella* prevalence of 0.03% at the individual carcass level. Three out of 2,973 lymph node samples from cattle were positive for *Salmonella* giving an estimated *Salmonella* prevalence of 0.10% at the individual carcass level. A total of 5,905 swab samples of cattle and swine carcasses were examined, and one sample was positive for *Salmonella* giving an estimated *Salmonella* prevalence of 0.02% at sample level. From a total of 2,785 samples of from meat scrapings meat (cattle, swine. Sheep), three samples were positive for *Salmonella* giving an estimated *Salmonella* prevalence of 0.11% at sample level.

In 2020, an outbreak of salmonellosis in wild birds spilt over into cats and to a lesser degree also dogs. Altogether 396 cats and 10 dogs were positive for *Salmonella* in 2020. This is a large increase compared to previous years. *Salmonella* was detected in samples of 8 of 180 tested wild boars.

Evaluation of the current situation

The number of salmonellosis cases in humans has decreased over the past 10 years. The number of cases infected in Norway has remained relatively stable with an incidence of 3.6 to 6.1 in the last 5 years (2015-2019) but decreased to 3.2 in 2020, probably due to measurements against COVID-19 in Norway. 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 (n=3 flocks in 2020). This variant is only rarely associated with disease in animals and is not considered a public health threat.

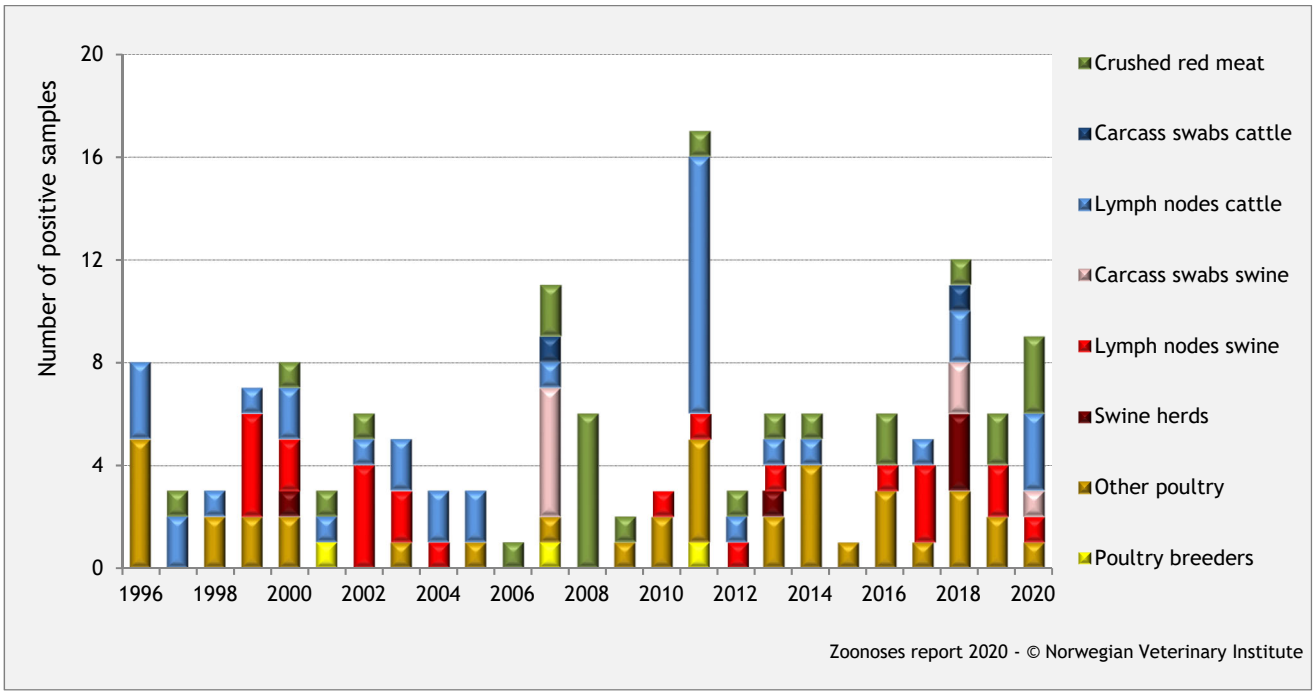


Figure 2. The number of positive samples in the *Salmonella* surveillance programme.

Salmonella is occasionally detected in dogs and cats and in reptiles in Norway, but in 2020 an increase in salmonellosis was evident particularly in cats. This coincided with an outbreak of salmonellosis in wild birds and a winter with less snow than usual which is likely to have enabled cats to hunt more easily.

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. *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*, 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 before 51 days of age between the 1st May and 31st October are tested prior to slaughter. Carcasses from positive flocks are heat treated 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 2020

In MSIS, 2,422 human cases of campylobacteriosis were reported in 2020, of which 1,513 contracted the infection in Norway. For 647 of the cases place of infection was unknown. This is a decrease compared to the number of cases reported last year and are mainly attributed to reduced travel abroad due to COVID-19 travel restrictions. The number of cases infected in Norway in 2020 is similar to 2019 (1,551 cases). However, at least 200 of the reported cases in MSIS in 2019 were related to the large waterborne outbreak in Western Norway (Hyllestad *et al*, 2019). If we disregard these cases, there is a slight increase in the number of domestic infections in 2020. The increase may be associated with more people spending the summer of 2020 in Norway and in the Norwegian nature due to the travel restrictions. This may have increased the use of untreated water/ water with poor quality in nature and cabins, as well as increased contact with livestock.

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, 2018 and 2019 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 poultry in 2020 showed that a total of 115 flocks (6.1%) tested positive for Campylobacter spp. when all broiler flocks slaughtered before 51 days of age during the period May – October were tested. In total 1 893 flocks from 490 farms were sampled. Of all farms sampled, 86 (17.6%) had positive flocks and of these, 24 (4.9% of all farms) had two or more positive flocks. This means that almost 50% of the positive flocks originated from less than 5% of the farms. The carcasses from the positive flocks were either heat treated or frozen for a minimum of three weeks before being marketed. Caecal samples from 117 turkey flocks were examined in NORM-VET. *C. jejuni* isolates were obtained from five flocks (4.3%) and *C. coli* from one flock (0.8%).

In the diagnostic services at the NVI, *Campylobacter* was detected in samples from 24 cattle, 56 dogs and 3 cats. Twenty one wild boar were also *Campylobacter*-positive. For details see the Appendix.

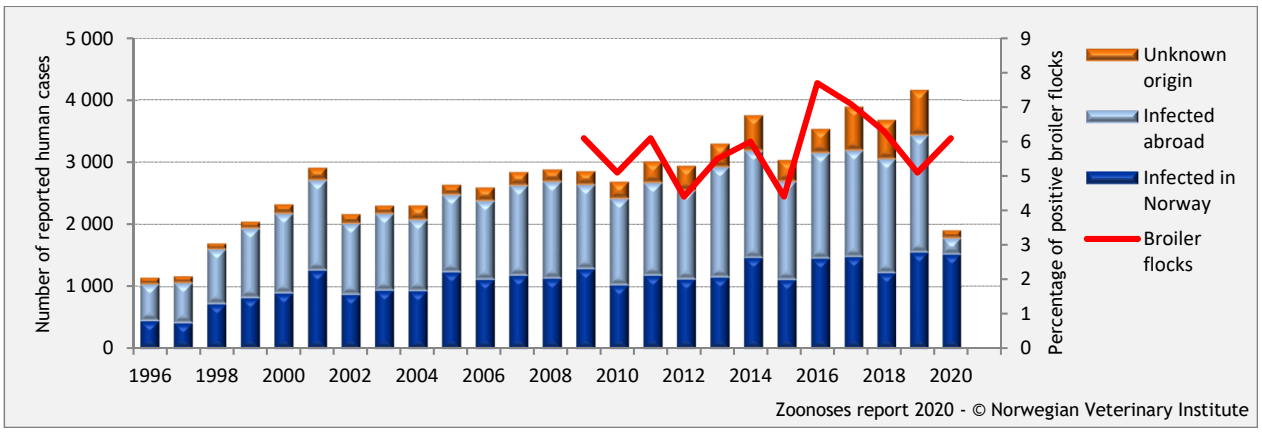


Figure 3. The number of reported cases of campylobacteriosis in humans (data from MSIS) and the percentage of positive broiler flocks (sampled between 1st May and 31st October).

Evaluation of the current situation

Campylobacteriosis is the most commonly reported zoonosis in humans in Norway. Usually more than half of the cases are reported as travel associated (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. 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 (3-7% of slaughtered flocks) compared to other countries. The measures implemented in Norway to reduce *Campylobacter* in chicken meat are considered 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 2020

The number of reported human cases of yersiniosis (83) was similar compared to last year (Figure 4). All reported cases in 2020 were caused by *Yersinia enterocolitica*. *Y. enterocolitica* O9 was detected in 3 pigs in one farm in 2020. Two hares and one dog were positive for *Y. pseudotuberculosis* in 2020.

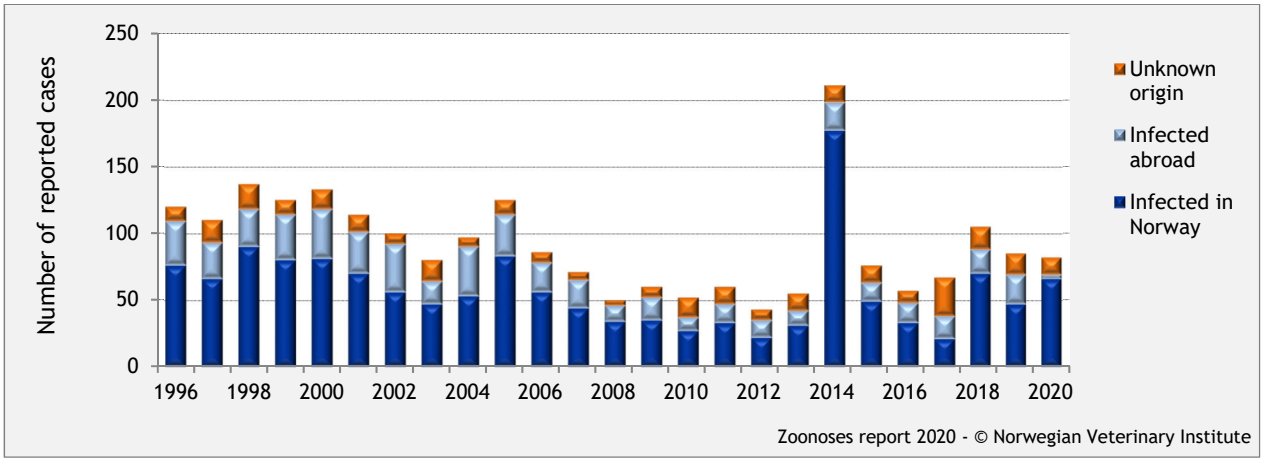


Figure 4. The number of reported cases of yersiniosis in humans. Data from MSIS.

Evaluation of the current situation

Most yersiniosis cases in humans in Norway are sporadic and have been acquired domestically. In 2014 and 2018, there was a significant increase in the number of reported cases due to outbreaks. In 2020, three outbreak investigations were conducted due to *Y. enterocolitica* O:3. The largest outbreak caused by *Yersinia enterocolitica* was reported in June 2020 with 25 cases. Analyses of patient interviews showed that 23 of the cases (92%) stated that they had eaten a pre-washed salad product that contained baby spinach or spinach the week before illness. However, the source of infection could not be confirmed through microbiological examinations of the product. The source of the infection of the other two outbreaks could not be identified, but the outbreak investigations indicated that the sources were likely to be a food with a short shelf life and a pre-cut salad product, respectively.

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. The main route of infection in is contaminated food or water, and listeriosis can cause fever, abortion, meningitis and septicaemia. In animals, listeriosis also causes meningitis and abortion, and feed is the main source of infection.

Surveillance and control
Listeriosis in humans is notifiable. In animals, it is categorised as a group C-disease and detection in animals usually does not result in any measures.

Detection of *L. monocytogenes* is part of the control system in the manufacture of certain food products. The upper limit in ready-to-eat foods is 100 cfu/g and 0 cfu/ml in products intended for small children or other vulnerable persons. 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; www.matportalen.no and www.fhi.no

Results 2020

The number of annual cases of listeriosis in humans continues to increase, and a total of 37 cases were reported in 2020 (Figure 5). Also for the rest of Europe an upward trend in the number of listeriosis cases has been observed in the last years. One outbreak of listeriosis was investigated in 2020 (4 cases), but the source of infection could not be identified.

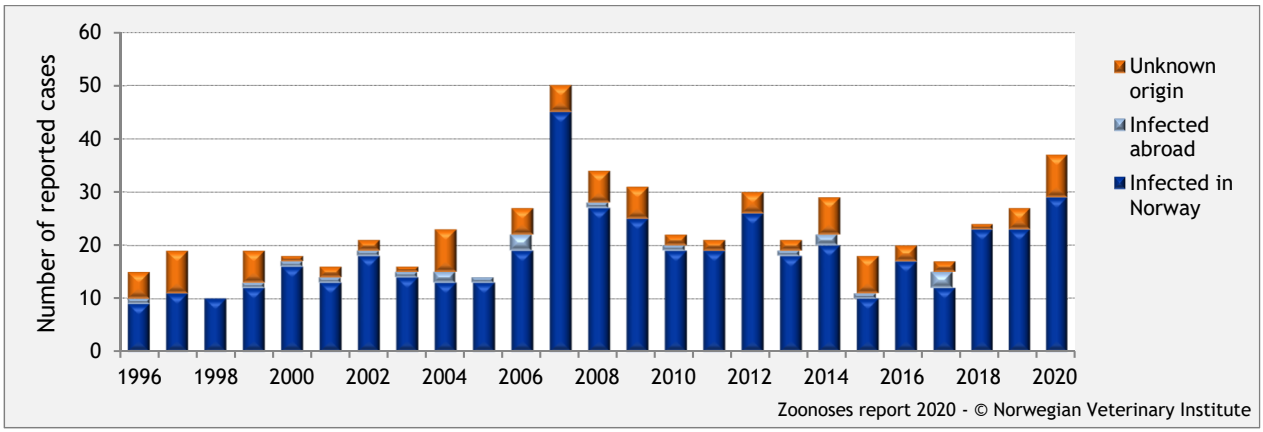


Figure 5. The number of cases of listeriosis in humans. Data from MSIS.

In the diagnostic services at the NVI, *L. monocytogenes* was detected in four sheep in 2020. The Institute of Marine Research (Havforskningsinstituttet) examined 135 samples of seafood from Norway for *L. monocytogenes*, four of which were positive, but with less than 100 cfu/g. Fifty seven samples of imported fish products were also analysed and four were positive, but with less than 100 cfu/g.

Evaluation of the current situation

The number of listeriosis cases in both humans and animals in Norway is low, but 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 2020

The number of reported EHEC cases in humans (n=331) decreased in 2020 compared to the previous years, mainly attributed reduced travel abroad due to COVID-19 restrictions (Figure 6). The number of cases developing HUS remains low (2-10 cases/year). In 2020, 60% of cases had low-virulent VTEC.

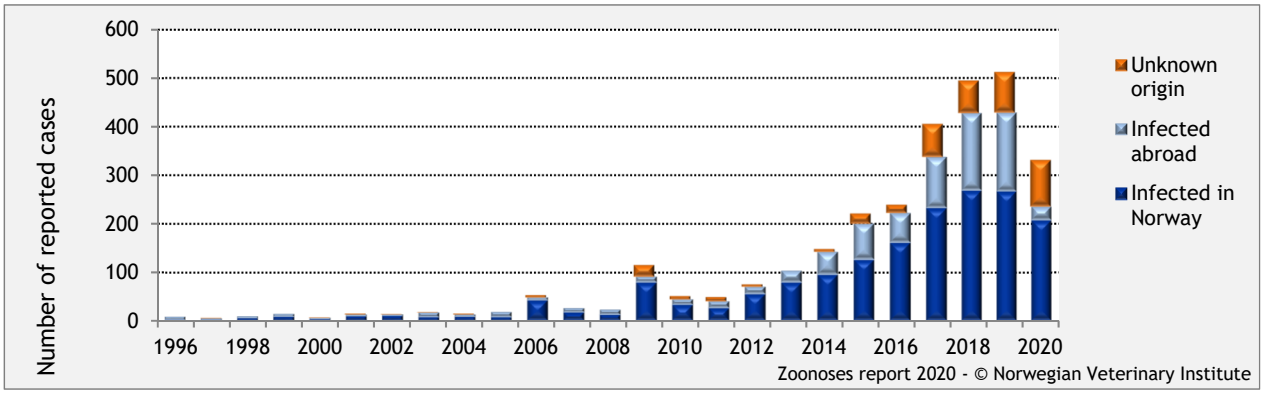


Figure 6. The number of reported cases of EHEC (enterohaemorrhagic *E. coli*) in humans. Data from MSIS.

Eight samples were received for analyses at the Norwegian Veterinary Institute in relation to investigation of one case of EHEC infection in a human in 2020. EHEC/STEC were not detected in theses samples.

Evaluation of the current situation

More than half of the cases of EHEC have been infected in Norway. The increase seen from 2012 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 (NVI) 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). In a survey of minced meat performed by the NVI in 2018, STEC were isolated from 2 of 308 samples, these two isolates belonged to serogroups O26 and O91.

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 non-tuberculous mycobacteria 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 2020

In total, 160 cases of tuberculosis in humans were reported in 2020. None of these was caused by *M. bovis,* and the infections were contracted abroad.

All cattle, sheep, goats, swine and horses commercially slaughtered were examined *post mortem*. In addition, 592 breeding pigs and 230 breeding bulls were tuberculin tested, and all were negative. As part of diagnostic testing, samples from 57 swine and one camel were tested for *Mycobacterium* spp. *Mycobacterium bovis* was not detected in any of the samples. Two cats were positive for *M. microti* in 2020.

Evaluation of the current situation

Mycobacterium 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 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 official free of brucellosis in cattle according to the EEA agreement. Although not officially recognized as such, Norway is also free from brucellosis in the small ruminants and swine populations.

Results 2020

Two cases of brucellosis in humans were reported in 2020, both of them were infected abroad.

As part of the surveillance programmes, 128 cattle from 43 herds 8, 701 sheep from 2,927 flocks, and 1,304 goats from 58 herds were tested. Antibodies against *Brucella* spp. were not detected. In addition, 444 breeding cattle and 2571 breeding pigs were tested and were negative for antibodies against *Brucella spp.* Fourty alpaca were tested due to export and were negative. Three dogs tested negative for *B. canis* antibodies and/or by culture.

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 2020

No cases of trichinellosis were reported in humans in 2020.

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. A health surveillance program for wild boar was started in 2018, and in 2020 samples from 197 wild boar harvested through hunting were tested for *Trichinella*, none were positive.

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 in 1981. *Trichinella* may be found in wild animals, and the parasite may transmit to domestic animals kept outside such as swine and horses. Since September 2018, hunters have had the opportunity to submit muscle tissue samples from wild boar hunted in Norway for free of charge *Trichinella* analysis when blood, feces and nasal swab samples are also submitted. The number hunted wild boar samples tested for *Trichinella* during 2018 and 2019 were 79, and during 2020 samples from 197 wild boar were tested. Trichinella was not detected in any of the samples during these three years

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 2020

Seven cases of echinococcosis in humans were reported in 2020, and all had contracted the infection abroad.

In the surveillance program for *E. multilocularis*, 532 foxes and 20 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.

Dog owners must ensure that dogs entering Norway from other countries are given antiparasitic treatment according to the regulations. 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 2020

As part of the diagnostic work at the NVI, 4 four sheep were tested serologically for *T. gondii*. None were positive.

Evaluation of the current situation

Toxoplasma gondii is prevalent in Norway, but 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.

Toxoplasma 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. In a seroscreening study of Norwegian cats, 41% of 478 cats were seropositive for *Toxoplasma*, and the risk of positivity increased with age (Sævik *et a*l, 2015). 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 2020

Rabies was not detected in humans in Norway in 2020.

Two dogs, and five arctic foxes from Svalbard, were tested for rabies at the NVI. Rabies was not detected in any of these. 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 animals 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 2020

Five cases of Q-fever in humans were reported in 2020. Three cases had contracted the infection abroad, and for two the place of infection was unknown.

At the NVI, blood samples from a total of 134 cattle were tested serologically for *C. burnetii* in the surveillance program (n=128) and before export (n=6). In addition 2 camels were tested after import. Antibodies were not detected in any samples. For further information see the Appendix.

Evaluation of the current situation

Q-fever is currently not a problem for human or animal health in Norway. The infection became notifiable in humans in 2012, and since then 25 cases have been reported in total. Of these, 23 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). Testing is regularly performed on imported animals and as part of diagnostic testing of sick animals and from 2012, serological testing for Q-fever has also been included on samples from cattle collected in the surveillance program for Brucella.

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 2020

No cases of vCJD were reported in humans in 2020.

In total, 6,691 cattle were tested, and all were negative for BSE.

Evaluation of the current situation

The situation with respect to classic BSE has always been 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

Antimicrobial resistant bacteria may be zoonotic and transmit through direct or indirect contact, including through food. One example is methicillin resistant *Staphylococcus aureus* (MRSA), which may transmit between animals and humans.

Surveillance and control
Infection and carriage of MRSA in humans is notifiable in Norway. Detection of some types of antimicrobial resistant bacteria in animals is notifiable, e.g. MRSA (NFSA). 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 bacteria from animals, feed and food (NORM-VET). In 2013, a separate surveillance programme 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. Detection of MRSA and several other forms of resistant bacteria in animals became notifiable in Norway in 2019.

Results 2020

Details on detection of selected bacteria 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 MRSA surveillance programme in 2020 did not detect any pig herds with MRSA. In total, 641 herds were included in the survey, of which 81 were genetic nucleus or multiplier herds, 12 herds were central units of the sow pool herds, 18 were of the largest farrow to grower or farrow to finish herds, and the remaining 530 were herds with more than 10 sows.

In 2020, a total of 33 Salmonella spp. isolates from animals were susceptibility tested. In total 23 of these isolates were S. Typhimurium and included one each from eight cats, five wild boars, four cattle, four dogs, one pig and one chicken, respectively. The remaining ten isolates belonged to eight different serovars. Nine of the isolates were fully susceptible to all antimicrobial classes tested for. Twenty isolates showed reduced susceptibility to colistin (MIC>2).

Campylobacter spp. from both broiler and turkey flocks were included in 2020. Only a few isolates of C. coli were detected, i.e. four from broiler and one from turkey. From turkey, only five *C. jejuni* isolates were detected, of which one was resistant to streptomycin. In total, 90.8% of the 87 *C. jejuni* isolates from broiler tested were susceptible to all antimicrobial agents included in the test panel. None of the isolates were MDR.

Evaluation of the current situation

Antimicrobial resistance in bacteria has become a serious threat to human and animal health globally. The prevalence of antimicrobial resistant bacteria is still low in both humans and animals in Norway compared to other European countries. However, the situation is under threat by the high use of antimicrobials globally.

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 biosecurity challenge 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 2020

In 2020, the NIPH received 23 notifications through Vesuv of possible or confirmed foodborne outbreaks outside health institutions. In total, 495 persons were reported to have become sick in these outbreaks. The number of affected persons in each of the outbreaks varied between 2 and 180 (median 10) Norovirus, *Cryptosporidium*, *Salmonella* and *Yersinia* caused three outbreaks each In 5 of the outbreaks, the causative agent was not identified (Figure 7).

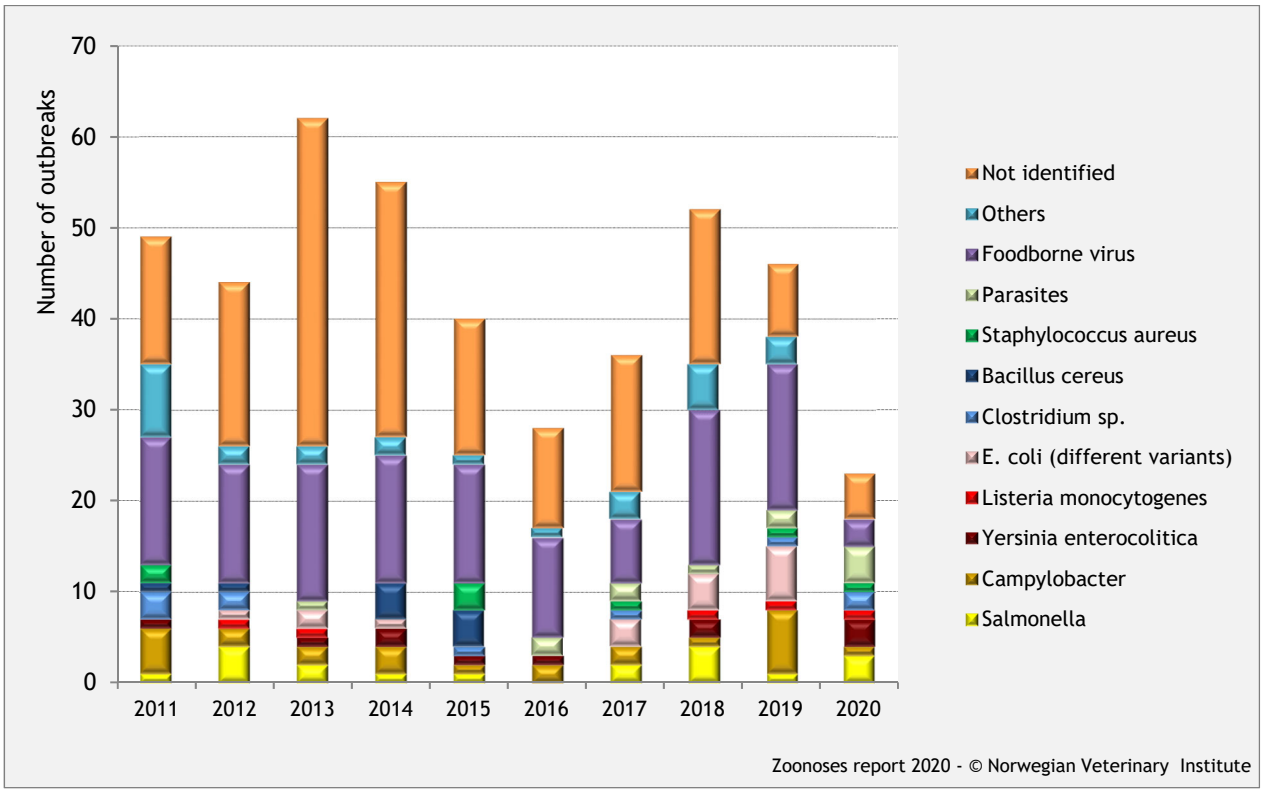


Figure.7. The number of reported foodborne outbreaks where an agent was verified or strongly suspected.

Appendix Tables

Table 1. Human population of Norway per 1st January 2020 (from statistics Norway).

Age group	Female	Male	Total
0 - 9	294 366	310 992	605 358
10 - 19	313 085	330 306	643 391
20 – 29	345 581	366 171	711 752
30 – 39	356 127	374 420	730 547
40 – 49	352 142	371 521	723 663
50 – 59	343 621	360 209	703 830
60 – 69	290 635	291 860	582 495
70 – 79	225 185	210 649	435 834
80 – 89	108 469	77 011	185 480
90 -	31 807	13 423	45 230
Total	2 661 018	2 706 562	5 367 580

Table 2. Animal population of Norway in 2020.

Animal species - category	Number*		
	Herds /flocks	Animals	Slaughtered animals
Cattle - total	13 300 [a]	877 000 [a]	294 900 [c]
Dairy production	6 000 [a]	167 000 [a]	
Meat production	4 600 [a]	84 100 [a]	
Other stock	980 [a]	46 800 [a]	
Sheep - total		1 902 000 [a]	1 192 600 [c]
Sheep >1 year	13 900 [a]	951 000 [a]	
Goats - total	1 300 [a]	64 800 [a]	25 320 [c]
Dairy goats	370 [a]	35 800 [a]	
Swine - total	1 900 [a]	742 000 [a]	1 574 300 [c]
Breeding pigs	1 000 [a]	42 600 [a]	
Slaughter pigs	1 700 [a]	417 000 [a]	
Chickens (*Gallus gallus*)			
Grandparent stock – egg producers	2 (3)[b1]		
Parent stock – egg producers	7 (21)[b1]		
Parent stock – broiler	89 (217)[b1]		
Laying hens	595 (882)[b]		
Broilers	570 (4 477)[b]		69 127 500 [c]
Turkey, goose and duck			
Parent stock	6 (20)[b1]		
Meat production	58 (296)[b]		1 213 850 [c]
Horse	4 500 [a]	23 700 [a]	59 [c]
Reared deer	160[a]	6 800[a]	

[a] Figures from the registry of production subsidy per 31.3.2020.
[b] Figures from the surveillance programme for *Salmonella* in 2020
[c] Figures from the Norwegian Agriculture Agency (based on delivery for slaughter)
[1] Production flocks only.

Table 3. The most common *Salmonella* serovars found in humans in Norway in 2020.

Serovar	Place of infection			Total
	Norway	Abroad	Unknown	
S. Enteritidis	29	79	29	137
S. Typhimurium	40	7	11	58
S. Newport	18	4	2	24
S. Stanley	4	17	3	24
S. Typhimurium monophasic variant	9	6	4	19
S. Oranienburg	9	1	2	12
S. Java	5	5	1	11
S. Braenderup	0	2	3	5
S. Montevideo	1	2	2	5
S. Panama	2	2	1	5
S. Virchow	2	3	0	5
S. Coeln	4	0	0	4
Others	49	48	34	131
Total	172	176	92	440

Table 4. Human cases of campylobacteriosis (infected in Norway) in 2020 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	2019	2020
Agder	63	54	55	81	41	57	77	44	51	71
Innlandet	108	96	113	121	82	107	152	114	113	136
Møre og Romsdal	54	36	47	73	34	32	71	59	47	62
Nordland	47	31	46	60	47	37	44	58	45	66
Oslo	113	136	103	121	56	54	109	145	126	165
Rogaland	177	124	169	129	116	150	205	130	118	150
Troms og Finnmark	38	26	29	74	55	76	71	56	66	66
Trøndelag	113	146	124	151	120	121	149	118	130	145
Vestfold og Telemark	79	90	76	119	68	62	147	109	239	121
Vestland	181	152	142	182	148	163	216	189	350	233
Viken	202	223	246	260	117	128	271	203	266	298
Total	**1175**	**1114**	**1150**	**1371**	**884**	**987**	**1512**	**1225**	**1551**	**1513**

Table 5. Foodborne outbreaks 2020.

Agent	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Salmonella sp.	1	4	2	1	1		2	4	1	3
Campylobacter sp.	5	2	2	3	1	2	3	1	7	1
Yersinia sp.	1		1	2	1	1	1	2		3
Listeria monocytogenes		1	1					1	1	1
Escherichia coli (VTEC)		1	2	1		1	3	4	6	0
Clostridium sp.	3	2			1		1		1	2
Bacillus cereus	1	1		4	4					0
Staphylococcus enterotoxin	2				3		1		1	1
Parasites			1			2	2	1	2	4
Virus	14	13	15	14	13	11	7	17	16	3
Other	8	2	2	2	1	1	1	5	3	0
Unknown	14	18	36	28	15	11	15	17	8	5
Total	**49**	**44**	**62**	**55**	**40**	**29**	**36**	**52**	**46**	**23**

Table 6. *Salmonella* in feed and feedstuff 2020.

Category	Number tested*	Number positive	Comment
Feedstuff			
Cereal grain	84	0	
Corn	41	0	
Rape	61 (2)	0	
Soya	2 646 (3)	3	*S*. Tennessee (1), *S*. Senftenberg (1), *S*. Amsterdam (1)
Sunflower	16	0	
Legume seeds etc.	10	0	
Tubers, roots etc.	7 (2)	0	
Other plant based feedstuffs	62	7	*S*. Rissen (3), *S*. enterica (2), *S*. Havana (1), *S*. Agona (1)
Meat based feedstuff	270	0	
Marine based feedstuff	137 (9)	0	
Feed			
Domestic animals (cattle, swine, poultry)	180 (74)	0	
Fish	2 218 (172)	0	
Fur animals	75	0	
Environmental samples in factories producing feed and feedstuff	16 428	173	33 different serovars

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

Table 7. *Salmonella* in animals 2020.

Category	Number* tested	Number* positive	Comment
Chicken – surveillance - breeding flocks	241	0	
Chicken – surveillance – layer flocks	882	0	
Chickens – surveillance – broiler flocks	4 477	1	S. Typhimurium
Chicken flocks – other samples	5	0	
Turkey, ducks, geese – surveillance - breeding flocks	20	0	
Turkey, ducks, geese – surveillance – meat flocks	296	0	
Turkey, ducks, geese – other samples	1	0	
Cattle – surveillance – animals	2 973	3	S. Typhimurium, S. Hessarek S. *diarizonae* 61:k:1,5,7
Cattle – diagnostics - herds	70	4	S. Typhimurium (3), S. Umbilo
Sheep – diagnostics - herds	10	3	S. *diarizonae* 61:k:1,5,7
Goats- diagnostics - herds	5	0	
Swine – surveillance – slaughter pigs - animals	1 795	1	S. Typhimurium
Swine – surveillance – sows - animals	1 450	0	
Swine – surveillance – breeding herds	78	0	
Swine – diagnostics - herds	10	0	
Horse – diagnostics – animal	17	0	
Dog - diagnostics	225	10	S. Typhimurium
Cat - diagnostics	588	396	S. Typhimurium
Alpaca– herds - diagnostics	2	0	
Camel– herds - diagnostics	1	0	
Wild boar – surveillance - animals	180	8	S. Typhimurium (5), S. *diarizonae* (2), S. *enterica*
Animals/birds/zoo birds/zoos	7	1	S. Poona
Reptiles	35	29	S. Flutern (4), S. *diarizonae* (4), S. Pomona (3), S. Ago (3), S. *houtenae* (2), S. *salamae* (3), S. arizonae (1), S. Muenster (2), S. Mundonobo (2), S. Java (2), S. Tennessee (1), S. Muenchen (1), S. Enteritidis (1)
Various wild animals	31	3	S. Enteritidis (2), S. Adeoyo (1)
Wild birds	18	8	S. Typhimurium

* Units for numbers are given in the first column.

Table 8. *Salmonella* in food 2020.

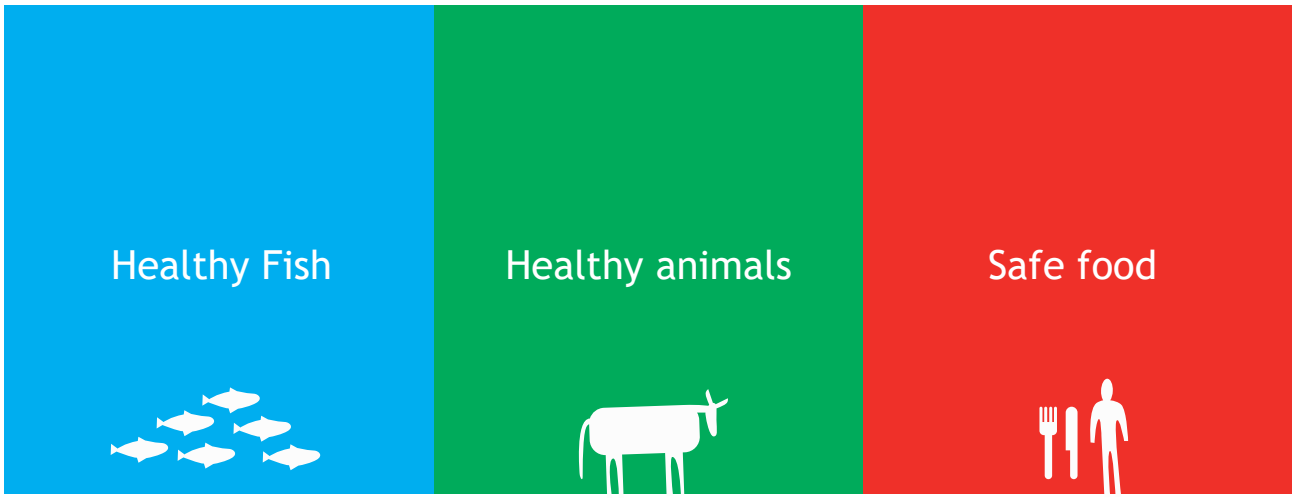
Category	Number sampled	Number positive	Comment
Cattle – swab of carcass - surveillance	2 865	0	
Swine - swab of carcass - surveillance	3 043	1	S. ent. subsp. *diarizonae* 61:k:1,5,7
Meat scrapings (cattle, swine. sheep) - surveillance	2 785	3	S. Typhimurium monophasic*, S. ent. subsp. *diarizonae* 61:k:1,5,7 (2)
Fish – Norwegian – IMR**	60	0	
Fish – Imported – IMR**	74	0	
Shellfish - Norwegian – IMR**	28	0	

* Isolated from imported swine meat
** Institute of Marine Research (Havforskningsinstituttet)

Table 9. Selected zoonoses in animals 2020. *Salmonella* is presented in separate tables.

Infection/agent	Category	Number tested	Number positive	Comment
Campylobacteriosis	Broiler chicken flocks - surveillance	1 893	115	May - October
	Cattle - diagnostics	74	24	*C. jejuni*
	Wild boar - surveillance	187	21	Campylobacter sp.
	Dog - diagnostics	186	56	*C. upsaliensis* (48), *C. jejuni* (8)
	Cat - diagnostics	18	3	*C. upsalensis* (2), *C. jejuni*
Tuberculosis	Cattle – tuberculin testing	230	0	
	Swine – tuberculin testing	592	0	
	Swine - diagnostics	57	40	*M. avium* subsp. *hominissuis*
	Camel - surveillance	1	0	
Brucellosis	Cattle - surveillance	128	0	
	Cattle – breeding animals, export	444	0	
	Sheep – surveillance	8 701	0	
	Goat - surveillance	1 304	0	
	Swine – breeding stock	2 571	0	
	Dog	3	0	
	Alpaca - export	40	0	
Echinococcosis	Fox - surveillance	532	0	
	Wolf - surveillance	20	0	
	Cattle, small ruminants, swine, horse	All slaughtered*	0	
Toxoplasmosis	Sheep - diagnostics	4	0	
Rabies	Dog – diagnostics	2	0	
	Arctic fox - diagnostic	5	0	
Trichinellosis	Pig and horse	All slaughtered*	0	
	Wild boar - surveillance	197	0	
Q-fever	Cattle - surveillance	128	0	
	Cattle - export	6	0	
	Camel – import	2	0	
BSE	Cattle	6 691	0	
MRSA	Swine - surveillance	641	0	

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



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