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Report on the monitoring of zoonoses and food-borne disease outbreaks
Data for 2017

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1 Summary

In 2017 campylobacteriosis was once again the zoonosis most commonly recorded in humans. A total of 7,219 cases of campylobacteriosis confirmed by laboratory diagnosis were reported, representing a reporting rate of 85.4 new cases per 100,000 inhabitants. This is a slight decrease compared with 2016 (7,688 cases), but campylobacteriosis remains by far the most commonly reported zoonosis throughout Switzerland. In most cases people are infected by contaminated food, with poultry meat the major source of infection. The bacterium, which is infectious for humans, occurs naturally in the gut of chickens and is not a threat to their health.

The second-most common zoonosis in Switzerland is salmonellosis. A total of 1,848 cases of salmonellosis that had been confirmed by laboratory diagnosis were reported in 2017, corresponding to a reporting rate of 22 new infections per 100,000 inhabitants. The number of cases increased slightly compared with 2016 (1,517). The number of salmonellosis cases in animals (105 cases) once again decreased slightly compared with 2016 (127 cases). Cattle, reptiles, dogs and cats were mainly affected.

In 2017 a total of 696 cases of infection with verocytotoxigenic *Escherichia coli* (VTEC) that had been confirmed by laboratory diagnosis were reported in humans, representing once again an increase of 50% on the number of cases reported in 2016 (463 cases). The reporting rate of 8.2 new infections per 100,000 inhabitants is the highest since mandatory reporting was introduced in 1999. The main cause of this increase is assumed to be the increase in testing for VTEC as a result of the new laboratory methods available, leading to a higher number of cases being identified.

In 2017 a total of 130 cases of tularaemia in humans were reported, corresponding to 1.5 cases per 100,000 inhabitants. This means that the number of cases has more than doubled since 2016. Tick bites were the main source of infection. Four cases of tularaemia were reported in animals (two hares, one squirrel, one monkey), which is about the same level as in previous years.

There were two special incidents in 2017 in addition to the cases identified by the annual monitoring programmes. In one case a man was bitten by a rabid bat and required immediate post-exposure treatment for rabies. The animal was carrying the European bat lyssavirus 1, and this was the first time that the virus had been identified in Switzerland. In the other case anthrax was identified in two cows at a dairy facility in the canton of Jura. The facility was reopened after the disease had been eliminated successfully. The last case of anthrax in Switzerland was reported more than 20 years ago in the canton of Schwyz.

Outbreaks of food-borne diseases have been rare in Switzerland for years. In the year under review, 18 such incidents were reported, slightly more than in 2016 (11 incidents).

2 Monitoring of zoonoses

Zoonoses are diseases which can be transmitted from animals to humans and vice versa. Humans can be infected with zoonotic disease pathogens through direct contact with infected animals or by eating contaminated food of animal origin. This is why the monitoring of zoonoses in animals, humans and food is of such central importance. Close interdisciplinary collaboration between veterinary and human medicine of the kind foreseen in the One Health approach is of major significance in this context. This is the only way to overcome complex health challenges such as zoonoses.

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1 A disease that can be transferred between people and animals.
In animals, campylobacteriosis, salmonellosis, listeriosis, verocytotoxigenic E. coli (VTEC) infection, tuberculosis (caused by Mycobacterium bovis), brucellosis, trichinellosis and echinococcosis are subject to mandatory reporting (Epizootic Diseases Ordinance (EzDO), Art. 291a, SR 916.401). Apart from echinococcosis, the same zoonoses in humans are also subject to mandatory reporting (FDHA Ordinance on Reporting Observations of Contagious Diseases in Humans, S: 818.101.126).

The monitoring methods and results for zoonoses subject to mandatory monitoring and an assessment of the situation are given in the following. In addition, this report describes the current situation with respect to Q fever (caused by infection with Coxiella burnetii), tularemia and West Nile fever, and two particular incidents involving zoonoses are explained.

The data on humans processed in the report are based on the reporting system of the Federal Office of Public Health FOPH. Information about this reporting system is available on the internet. The numbers of cases in animals are taken from the animal disease reporting system (InfoSM) operated by the Federal Food Safety and Veterinary Office FSVO. Outbreaks of food-borne diseases are reported to the FSVO by the cantonal chemists.

2.1 Campylobacteriosis / Campylobacter contamination

Campylobacteriosis is an infection of the gastrointestinal system caused by bacteria of the genus Campylobacter and typically causes diarrhoea in humans. Animals, and young animals in particular, may also develop campylobacteriosis but this is rare. Campylobacter colonises the gastrointestinal tract of healthy pigs and poultry. The bacterium may be transferred to meat during the slaughtering process. This means that fresh, contaminated poultry meat – particularly meat obtained from chickens – is a significant source of infection for humans. Good hygiene can reduce the risk of infection substantially (see https://sichergeniessen.ch/). Humans can also be infected through direct contact with animals, by contaminated water or while travelling in countries with poor hygiene standards.

2.1.1 Mandatory reporting and case numbers in humans

Diagnostic laboratories have a duty to report evidence of Campylobacter in humans. Doctors are also required to report instances in which several cases occur at the same time in the same place – e.g. in the form of food poisoning (FDHA Ordinance on Reporting Observations of Contagious Diseases in Humans, S: 818.101.126).

A total of 7,219 cases of campylobacteriosis that had been confirmed by laboratory diagnosis were reported to the FOPH in 2017 (Figure CA—1). This corresponds to a reporting rate of 85.4 new infections per 100,000 inhabitants. This is a slight decrease compared with 2016, but campylobacteriosis remains the zoonosis most commonly reported to the FOPH.

As in previous years, the highest reporting rate was for young adults in the 15 to 24 age group: 115 cases per 100,000 inhabitants. The reporting rate for the over-64 age group is striking. It has doubled in the past two decades (1997: 43 cases per 100,000 inhabitants, 2017: 103 cases per 100,000). The reporting rate in children under five years of age, on the other hand, decreased during the same period from 147 to 94 cases per 100,000. As in previous years, men (55%) were affected slightly more often than women (45%). This was observed for nearly all age groups apart from young adults between 15 and 24, in whom the reporting rate was slightly higher for women than for men (115 versus 112 per 100,000 inhabitants).
Campylobacteriosis typically takes a seasonal course, with an initial increase in the summer that peaked at 1,050 cases in August. As in previous years, there was a second brief increase during the end-of-year celebrations.

More detailed information on the species of *Campylobacter* involved was available for 6,003 cases (83%). 72% were caused by *C. jejuni*, 7% by *C. coli* and 20% by *C. jejuni* or *C. coli* (not differentiated).

![Campylobacteriosis in humans](image)

**Figure CA—1**: Number of cases of campylobacteriosis reported in humans, 2008–2017.

(Source: Federal Office of Public Health, April 2018)

### 2.1.2 Mandatory reporting and monitoring in animals

Campylobacteriosis in animals must also be reported to the authorities and is among the epizootic diseases that must be monitored (EzDO, Art. 5).

**Campylobacteriosis**: 122 cases of campylobacteriosis were reported in animals in 2017. Following sharp rises in 2013 and 2014, reports have been declining slightly since 2016. In the last ten years (2008–2017), the number of cases has fluctuated between eight and 164 per year. Dogs were most frequently affected (66%), followed by cattle (16%) and cats (11%) (Figure CA—2).

The increase in the number of cases between 2103 and 2105 was due mainly to the higher number of reports in dogs. More confirmatory tests were done in the reference laboratory, and this is often the decisive factor in cantonal veterinary offices also reporting a positive identification as a case. However, it is likely that there was an increase in positive identifications overall, since the number of tests recorded in the laboratory database in 2014 and 2015 is not much higher than in 2013.
Campylobacteriosis in slaughter animals: Pigs and broiler chickens are actively monitored for Campylobacter as the meat – and poultry meat in particular – may be contaminated during the slaughtering process and thus constitute a source of infection for humans. Since 2014 slaughtering facilities have been testing broiler chickens (2014, 2016, etc.) and pigs (2015, 2017, etc.) every two years as part of the antibiotic resistance programme.

No data are available for broiler chickens in 2017. Between 2010 and 2014 the average annual prevalence recorded using cloacal swabs was between 33% and 38%. In 2016 samples were taken from the caecum (appendix) at the slaughtering facility. The average annual prevalence here was 35%.

Samples were taken from the caecum of pigs in slaughtering facilities and tested for Campylobacter. In 2017, 170 out of 298 pigs (57%) were positive for Campylobacter (161 x C. coli, 9 x C. jejuni). While the prevalence was slightly lower in 2012 and 2015 than in 2017 at 48-52%, it was higher in 2009, 2010, 2011 and 2013 at 65-68%. Mainly C. coli is found in pigs.

2.1.3 Monitoring in food

Due to cross-contamination at slaughtering facilities, poultry meat from flocks that were originally Campylobacter-negative may also be contaminated with the pathogen by the end of the slaughtering process. Poultry carcasses and poultry meat are therefore monitored by the poultry industry. A total of 1,232 inspections were carried out in 2017 under this self-monitoring system. 362 (27%) of them were positive for Campylobacter, with the following distribution of bacterial strains: 101 x C. jejuni (31%), 27 x C. coli (8%) and 198 x not typed (61%).
In the last four years, the proportion of positive samples among the approximately 1,300 poultry meat samples inspected per year was between 24% and 37%. The baseline study carried out in 2008 of the prevalence of *Campylobacter* in broiler chicken flocks and the prevalence of *Campylobacter* / *Salmonella* on broiler chicken carcases showed that 286 out of 408 neck skin samples from slaughter carcases (70%) were positive for *Campylobacter*. Screenings of poultry meat from the retail trade in 2007 and 2009/10 found *Campylobacter* in 44% and 38% of raw meat samples respectively.

### 2.1.4 Measures / Prevention

No direct action is taken with respect to campylobacteriosis and slaughter animals contaminated with *Campylobacter*. Since poultry plays such a prominent role as a source of infection for humans, good hygiene practice (GHP) must be observed during fattening to ensure that poultry flocks arrive at the slaughtering facility as free of contamination as possible (see poster “Good Hygiene Practice in Poultry Fattening”).

The Ordinance on Primary Production stipulates that any food produced must not be harmful to human health. Since 1 January 2014, poultry livers from a *Campylobacter*-positive flock may therefore only be brought onto the market in frozen form (Hygiene Ordinance, Art. 33). This significantly reduces the bioburden in poultry livers. Furthermore, the packaging of fresh poultry meat and any preparations containing it must display hygiene advice. This informs the consumer how to handle fresh poultry meat hygienically in the home and states that these products must be heated through completely before eating. The information that the product must be heated through completely before eating is also given on the packaging of meat products obtained from poultry meat, minced meat (irrespective of the animal species from which it is made because the greater surface area and partly destroyed cell membranes make it highly perishable), and meat preparations (particularly those containing meat separated mechanically from bones, known as mechanically separated meat (MSM) (Ordinance on Foodstuffs of Animal Origin, Art. 10).

The Hygiene Ordinance that entered into force on 01.05.2017 stipulates a process hygiene criterion for *Campylobacter* in poultry slaughter carcases, with a transitional period until 30.04.2018. Under this criterion, a certain number of slaughter carcases are tested for *Campylobacter* after chilling and the germ titres found must not exceed a certain threshold. If the threshold is exceeded, the slaughtering facility must take measures within the slaughtering process to bring about a reduction in the germs.

A broad-based communication campaign is also being launched in conjunction with the industry to inform people about the risks linked to handling meat and how to handle food hygienically in the home. If consumers adhere to the rules on kitchen hygiene (see also https://sichergeniessen.ch/), they can successfully protect themselves against infection. The risk of infection can be reduced, for example, by using only frozen meat for meat fondue and by using separate crockery and cutlery for raw meat and food that is ready to eat. Good kitchen hygiene should be observed in general when preparing fresh chicken. This means that raw meat or marinades used preparatory to barbecuing meat should not come into contact with ready-to-eat food such as side dishes and salads.

### 2.1.5 Assessment of the situation

Currently almost 1 in every 1,000 people develops campylobacteriosis every year. As many infected people do not go to the doctor and stool samples are not always tested, the actual number of cases is probably significantly higher than the figure recorded by the reporting system.
People most commonly become infected through contaminated food. A comparison of human and animal *Campylobacter* strains from 2001 to 2012 showed that 71% of cases in humans are identical to strains found in chickens (Kittl et al., 2013). This makes poultry meat the main source of infection.

The incidence of *Campylobacter* in broiler chicken flocks has stagnated at a high level for years, with clear peaks during the summer months. This seasonal distribution affects the number of cases in humans, which is higher in the summer. Another reason for the increase in cases during the summer is the barbecue season and a higher number of trips abroad.

A study carried out by the Swiss Tropical and Public Health Institute (Swiss TPH) in 2014 identified the main reason for infection in winter (Bless et al., 2014). It investigated cases of sickness reported between December 2012 and February 2013 and compared these with healthy control cases. It found that eating meat fondue (e.g. fondue chinoise) increases the risk of infection, particularly if fresh poultry meat is used. The study also showed that half of patients were sick for at least a week. Around 15% required inpatient treatment in a hospital.

Meat from other animal species is less significant as a source of infection as *Campylobacter* does not usually survive on the surface of their carcasses. In the study mentioned above (Kittl et al., 2013), 19% of cases were attributable to cattle and 1% to pigs.

The precise reasons for the increase in the number of cases in dogs in 2014/15 are not known. Risk factors for *Campylobacter* infection in dogs include age (dogs under one year old), poor hygiene, a large number of flies, a high dog density (animal shelters, boarding kennels) and feeding with raw, uncooked meat (e.g. BARF feeding). This latter practice has become more popular in recent years. Direct contact with dogs, however, plays only a minor role in *Campylobacter* infections in humans. The proportion of human strains that could be traced back to dogs in the above-mentioned study was 9% (Kittl et al., 2013).

### 2.2 Salmonellosis / *Salmonella* infection

Salmonellosis is a common diarrhoeal disease (including vomiting and abdominal cramps) caused by infection with bacteria from the genus *Salmonella*. People often contract the infection from contaminated food – in particular eggs, unpasteurised milk and meat but also contaminated food of non-animal origin (e.g. salads, vegetables). As *Salmonella* multiplies in food at room temperature, perishable foods should always be stored in a cool place. Meat dishes must be cooked through (see [https://sichergeniessen.ch/](https://sichergeniessen.ch/)).

Infection with *Salmonella* may also occur, however, as a result of direct contact with infected animals or humans.

Animals may be carriers of *Salmonella* without actually being ill. This is known as asymptomatic *Salmonella* infection. To keep animal populations as free of *Salmonella* as possible, it is important to ensure good hygiene in their stalls.

#### 2.2.1 Mandatory reporting and case numbers in humans

Diagnostic laboratories must report evidence of *Salmonella* in humans. Doctors are also required to report instances in which several cases occur at the same time in the same place – e.g. in the form of food poisoning (FDHA Ordinance on Reporting Observations of Contagious Diseases in Humans 818.101.126).

A total of 1,848 cases of salmonellosis confirmed by laboratory diagnosis were reported in 2017 (previous year: 1,517 cases). This corresponds to a reporting rate of 22 new infections per 100,000 inhabitants. The number of cases is slightly up on previous years (Figure SA—1). As in previous years, the age group with
the highest reporting rate was children under five years of age (< 1 year: 56 per 100,000; 1- to 4-year-olds: 53 per 100,000). The typical seasonal increase in reports during the summer and autumn months was evident once again in 2017. The most commonly reported serovars remained *S. enteritidis* (38%), followed by *S. typhimurium* (13%) and the monophasic strain 4,12:i:- (11%).

![Salmonellosis in humans](image)

**Figure SA—1**: Number of cases of salmonellosis reported in humans, 2008–2017.

(Source: Federal Office of Public Health, April 2018)

### 2.2.2 Mandatory reporting and monitoring in animals

Infection with *Salmonella* (salmonellosis) must be reported for all animal species – in poultry asymptomatic infection with *Salmonella* (healthy carriers) must also be reported. Both forms of the infection belong to the group of epizootic diseases subject to control ([EzDO](#), Art. 4, Art. 222–227 and Art. 255–261). Anyone who keeps or cares for animals must report any suspicious cases to their vet.

**Salmonellosis in animals**: A total of 105 cases were reported in 2017. The case numbers have declined slightly since the peak in 2016, when 127 cases were reported. In previous years the main animal species affected were cattle, reptiles, dogs and cats (Figure SA—2). In the past 10 years (2008–2017), between 50 and 127 salmonellosis cases were reported per year (34% cattle, 29% reptiles, 19% dogs and cats and 4% sheep).
Salmonella infection in poultry: The occurrence of Salmonella in poultry needs to be kept as low as possible so that people are infected less often with these pathogens as a result of eating eggs and poultry and correspondingly fewer cases of salmonellosis develop in humans. A control target of a prevalence of <= 1% in breeding and broiler chickens and <= 2% in laying hens has been set. These targets apply to serovars that most frequently threaten human health. These are S. enteritidis and S. typhimurium (including the monophasic strain 1,4,[5],12:i:-) and additionally S. virchow, S. hadar and S. infantis in breeding flocks. If these serovars are identified in the course of monitoring samples obtained from the animals, control measures are initiated. Epizootic events are registered in the epizootic diseases reporting information system (InfoSM) and published.

Poultry facilities with more than 250 breeding animals, 1,000 laying hens, 5,000 broiler chickens or 500 turkeys must be inspected for Salmonella in accordance with requirements of the Technical instructions on the taking and screening of samples for Salmonella infections in domestic poultry. The samples are usually taken by the poultry farmers themselves.

In 2017, six cases of salmonellosis in flocks in the monitoring programme were reported in the epizootic diseases reporting information system. S. enteritidis was identified four times in laying flocks, S. typhimurium once each in a broiler chicken flock and a turkey flock. S. enteritidis was also found in three small flocks of laying hens outside the monitoring programme.

A total of 16 suspected events in laying and broiler hens were reported in 2017. In these cases the presence of Salmonella was not confirmed in the samples from 20 animals. In addition, further Salmonella serovars were diagnosed (see Table SA—1).
Table SA—1: Identification of *Salmonella* in poultry in 2017 (source: Alis).

<table>
<thead>
<tr>
<th>Category of animal</th>
<th>Event</th>
<th>Serovar</th>
<th>Number of serovars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breed Laying line</td>
<td>–</td>
<td>S. <em>ajobo</em></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>fluntern</em></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>havana</em></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>mbandaka</em></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>menston</em></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>newport</em></td>
<td>1</td>
</tr>
<tr>
<td>Breed Rearing line</td>
<td>–</td>
<td>S. <em>veneziana</em></td>
<td>1</td>
</tr>
<tr>
<td>Monitoring programme</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laying hens</td>
<td>Epizootic event</td>
<td>S. <em>enteritidis</em></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Suspected case</td>
<td>S. <em>enteritidis</em></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>typhimurium</em></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>typhimurium</em>, monophasic</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>S. <em>mbandaka</em></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>livingstone</em></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>senftenberg</em></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Epizootic event</td>
<td>S. <em>typhimurium</em></td>
<td>1</td>
</tr>
<tr>
<td>Broiler chickens</td>
<td>Suspected case</td>
<td>S. <em>typhimurium</em></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>typhimurium</em>, monophasic</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>S. <em>monophasic</em> (:::23,13:::i::)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>oranienburg</em></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>fresno</em></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>tennessee</em></td>
<td>1</td>
</tr>
<tr>
<td>Fattening turkeys</td>
<td>Epizootic event</td>
<td>S. <em>typhimurium</em></td>
<td>1</td>
</tr>
<tr>
<td>Outside monitoring programme</td>
<td>Laying hens (&lt;1,000 spaces)</td>
<td>Epizootic event</td>
<td>S. <em>enteritidis</em></td>
</tr>
<tr>
<td></td>
<td>Suspected case</td>
<td>S. <em>typhimurium</em></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>typhimurium</em>, monophasic</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>S. <em>monophasic</em> (:::-11:::e,n,x)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. <em>napoli</em></td>
<td>1</td>
</tr>
</tbody>
</table>

Poultry farmers whose poultry must be tested for *Salmonella* are required to register each of their flocks in the Animal Transport Database (TVD) when they are cooped. The screening request generated in the TVD must be used to screen these flocks. The TVD automatically fills in key details of the cooped flock, such as the TVD number, flock ID, flock size and intended use.
The Alis laboratory database evaluates the data from this monitoring programme. The screened flocks can only be included in the evaluation if the screening request generated in the TVD, which contains all the key details of the flocks, is sent to the laboratory with the samples.

The process of reporting flocks on cooping and using the pre-filled screening request from the TVD was introduced in 2016; it was not yet being used optimally in 2017. It was possible to assign the screening results to the cooping reports for 47% of the breeding and laying hen flocks. This does not mean, though, that more flocks were not screened. In these cases important information (such as the unique flock identification number) was missing from the screening request, and the results could therefore not be used in the evaluation. Sampling of poultry for fattening can be reduced to one flock per calendar year if Salmonella have not been found in a poultry facility during at least six production cycles. A figure of 15-20% can be expected here (see Table SA—2).

Table SA—2: Evaluation of the Salmonella monitoring programme in 2017 (source: FSVO data warehouse and Alis)

<table>
<thead>
<tr>
<th>Intended use</th>
<th>Number of flocks recorded in TVD</th>
<th>Number of flocks for which the screening request from TVD with a flock ID was used</th>
<th>Number of events reported</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breed Laying line</td>
<td>116</td>
<td>30 (26%)</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Breed Fattening line</td>
<td>66</td>
<td>50 (76%)</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Laying hens</td>
<td>812</td>
<td>384 (47%)</td>
<td>4</td>
<td>1.0%</td>
</tr>
<tr>
<td>Broiler chickens</td>
<td>3,604</td>
<td>499 (14%)</td>
<td>1</td>
<td>0.2%</td>
</tr>
<tr>
<td>Fattening turkeys</td>
<td>92</td>
<td>18 (20%)</td>
<td>1</td>
<td>5.6%</td>
</tr>
</tbody>
</table>

### 2.2.3 Monitoring in food

**Monitoring in meat:** The poultry industry monitors its production as part of its self-regulation. The following evaluation is based only on Swiss poultry meat, which is frequently less contaminated than imported meat. In 2017, 27 of 3,532 samples were positive for Salmonella (1%; S. Albany (17), S. Typhimurium (four), S. Infantis (one), S. Chester (1), S. Welikade (one) and Salmonella spp. (3)). Positive samples were found in neck skin (6 in chickens, 8 in fattening turkeys), fresh poultry meat (3 in chicken meat, 9 in turkey meat) and meat preparations (1 in chickens). The proportion of positive samples from Swiss poultry meat over the past 5 years has fluctuated between 0.2% and 2% of the approximately 3,000 samples tested annually.

In 2007, broiler chicken meat sold in retail outlets in Switzerland was subjected to more intensive testing. One of the 245 Swiss samples was positive for Salmonella (0.4%). The proportion of positive samples in meat from abroad was substantially higher at 15.3% of 170 samples. The positive samples originated mainly from Hungary, with some from Poland, Germany, France and Brazil. The baseline study carried out in 2008 of the prevalence of Campylobacter in broiler chicken flocks and the prevalence of Campylobacter / Salmonella on broiler chicken carcases showed that 2.6% of the broiler chicken slaughter carcases were positive for Salmonella.
Monitoring in dairy products: in 2015/2016, the Institute for Food Sciences (IFS) at Agroscope carried out a study in which random samples of Swiss cheeses made from raw milk or milk heated to only a low temperature were screened for various pathogens, including Salmonella. All 948 samples (2015: 844; 2016: 104) were negative for Salmonella. Between 2002 and 2009, dairy products were monitored regularly for Salmonella as part of the national screening programme for dairy products. Routine screening for Salmonella under this programme was stopped in 2009 because Salmonella had never been identified since 2004.

2.2.4 Measures / Prevention

Salmonellosis in animals: If salmonellosis occurs in ungulates, the sick animals must be isolated and the entire herd and its environment must be tested for Salmonella. If it is not possible to isolate the animals, the entire facility must be quarantined to prevent animals from leaving the facility (EzDO, Art. 69). The only exceptions are healthy animals going to slaughter. The comment “salmonellosis” must be written on the accompanying documentation. Milk from dairy cows with salmonellosis may at most be used as animal feed provided it is boiled or pasteurised beforehand.

If animals other than ungulates contract salmonellosis, appropriate measures must be taken to prevent risk to humans and to stop the epidemic from spreading further.

Salmonella infection in poultry: If one of the serovars designated as relevant in the legislation governing epizootic diseases is detected in the environment of poultry flocks, this is defined as a suspected case. If Salmonella are identified in organs or muscles of 20 animals in these flocks, this counts as an epizootic event and the facility is quarantined to prevent infected animals from leaving (EzDO, Art. 69). The poultry meat and eggs from such flocks may only be used if they have previously undergone heat treatment to destroy the Salmonella. The quarantine on the farm can only be lifted once all animals in the infected population have been killed or slaughtered and the premises have been cleaned and disinfected and have tested negative for Salmonella.

Evidence of Salmonella in food: Annex 1 of the Hygiene Ordinance, “Microbiological criteria for foods”, stipulates limits for Salmonella in various foods. If these are exceeded, the cantonal chemists must report this to the FSVO. The foods affected are confiscated and destroyed. Depending on the situation, products may also be recalled and the public may be warned against consumption of these products.

Packs of minced meat (irrespective of the animal species from which it originates, since the greater surface area and partly destroyed cell membranes make it highly perishable), products made of poultry meat and meat preparations (especially those containing mechanically separated meat) must bear clear information to the effect that these products must be heated through completely before eating (Ordinance on Foodstuffs of Animal Origin, Art. 10).

All large cheese manufacturers have a hygiene management system that complies with ISO 9000.

The same applies to Salmonella infections as to Campylobacter infections: good kitchen hygiene is important to prevent salmonellosis in humans.

2.2.5 Assessment of the situation

The number of reported salmonella cases in humans decreased from over 6,000 annually in the early 1990s to approx. 1,300 annually in 2009. The main factor in the declining case numbers since the early 1990s is the programme to control S. enteritidis in breeding and laying hens that has been in place since 1995. Case
numbers stagnated at this level between 2009 and 2014. There has been an increase in the number of reports since 2015. The reason for this is not known.

The situation regarding *Salmonella* in poultry is good in Switzerland. The monitoring programme identified and controlled *Salmonella* infection in six commercial flocks in 2017. Since 2007, 53 *Salmonella* infections per year in poultry have been reported in InfoSM. These generally affected laying hens. To date, six cases have been reported in broiler chickens and one each in breeding flocks and fattening turkey flocks.

A large number of further serovars were found in 2017, mainly in breeding flocks. These serovars are not among those most commonly identified in humans. Even if identification of these serovars does not result in health-related measures, they may represent a threat to human health. The further development of this situation needs to be monitored.

The improvement in data quality that can be achieved by using the pre-filled screening request in the TVD has not yet been fully realised. If the number of flocks that can be included in the evaluation remains too low, there is a risk that the objectives of the control programme may not be achieved. The flock prevalence in 2017 was 5.6% and thus substantially higher than the target of 1%. Since the number of flocks was below 100, a special provision stipulates a maximum of one positive flock as the target.

### 2.3 Listeriosis

*Listeria* bacteria are ubiquitous. The clinical picture of listeriosis is varied in both humans and animals. Humans mainly become infected through eating contaminated food or, more rarely, via direct contact with sick animals or abortion material. Good hygiene when handling food is an important preventive measure. Pregnant women and immunocompromised people should avoid raw meat and sausage products and products made from unpasteurised milk.

Although all animal species may be affected, listeriosis occurs mainly in cattle, sheep and goats. One risk factor is feeding with insufficiently acidified silage in which bacteria can reproduce.

#### 2.3.1 Mandatory reporting and case numbers in humans

Laboratory evidence of *Listeria monocytogenes* in humans must be reported to the authorities, and doctors providing treatment have also had to report the clinical findings since 1 January 2016. Laboratories and doctors are required to report instances in which several cases occur at the same time in the same place – e.g. in the form of food poisoning ([FDHA Ordinance on Reporting Observations of Contagious Diseases in Humans, 818.101.126](https://fdha.admin.ch/gesetze/de/818.101.126.html)).

A total of 45 cases of listeriosis that had been confirmed by laboratory diagnosis were reported to the FOPH in 2017, corresponding to a reporting rate of 0.5 new infections per 100,000 inhabitants. The number of cases reported is within the typical annual fluctuation (Figure LI—1). One case occurred in a pregnant woman. A further four cases were reported in newborn children. As in previous years, the highest rate was reported in people over 64 years of age, with 2.1 new cases per 100,000 inhabitants. A total of 27 women (60%) and 18 men (40%) were affected. The serovar was identified in 40 of the 45 cases recorded. The most common serotypes, as in previous years, were 4b (18 cases, 45%), 1/2a (15 cases, 37.5%) and 1/2b (7 cases, 17.5%).

In addition to the above individual cases, there may also be clusters of cases. If these are related, they are referred to as outbreaks. The most recent major registered outbreak of listeriosis (serotype 4b) occurred at
the turn of 2013/2014. It was most probably due to packaged, ready-to-eat salad. Other outbreaks of listeriosis occurred in 2011 (serotype 1/2a; imported cooked ham) and 2005 (serotype 1/2a; contaminated cheese) and from 1983 to 1987 (serotype 4b). The latter involved contaminated Vacherin Mont d’Or cheese and led to the largest outbreak of listeriosis to date in Switzerland, in which 122 people became ill and 33 died.

![Listeriosis in humans](chart.png)

**Figure LI—1:** Number of cases of listeriosis reported in humans, 2008–2017.

(Source: Federal Office of Public Health, April 2018)

### 2.3.2 Mandatory reporting and monitoring in animals

Listeriosis in animals must be reported to the authorities and is among the epizootic diseases that must be monitored (EzDO, Art. 5). In 2017, eight cases of listeriosis were reported in ruminants. In the last ten years (2008-2017), the number of cases reported has fluctuated between six and 21 per year. Cattle were most frequently affected (39%), followed by sheep (32%) and goats (26%) (Figure LI—2).
2.3.3  *Listeria* monitoring in food

**Monitoring in dairy products:** During 2017, a total of 1,433 cheese samples and 224 environmental samples were tested for *Listeria* as part of the *Listeria* Monitoring Programme (LMP) run by Agroscope. *Listeria monocytogenes* was found in four samples (0.2%, three environmental samples, one sample from the surface of cheese). Other types of *Listeria* were identified in 25 samples (1.5%).

The LMP was launched in 1990. Between 2007 and 2015 it tested 2,700 to 5,200 samples annually. *L. monocytogenes* has consistently been detected in less than 1% of samples, usually in environmental samples. When samples of cheese were affected, the pathogen was only generally found on the surface of the cheese.

2.3.4  Measures / Prevention

The *Hygiene Ordinance* stipulates limits for *Listeria* in various foods. If these are exceeded, the cantonal chemists must report this to the FSVO. The foods affected are confiscated and destroyed. Depending on the situation, products may also be recalled and the public may be warned against consumption of these products. The packaging of minced meat, meat products made from poultry and meat preparations (particularly those containing *mechanically separated meat*) must bear information stating explicitly that these products must be heated through thoroughly before consumption (*Ordinance on Foodstuffs of Animal Origin*, Art. 10). All large cheese manufacturers have a hygiene management system that complies with ISO 9000.
2.3.5 Assessment of the situation

Infections with *L. monocytogenes* repeatedly lead to illness in people. Even though the number of cases is small, the mortality rate is high, particularly among elderly people. In order to avoid infections with *Listeria*, it is particularly important to monitor for *Listeria* at the different stages of the food chain. Milk and dairy products are subject to particularly close monitoring on account of the major outbreak in the 1980s (the LMP Listeria Monitoring Programme run by Agroscope). For years now, only low levels of *Listeria* have been detected in the dairy sector. This is also true of the detection of *Listeria* in livestock.

2.4 Verocytotoxigenic *Escherichia coli*

Various strains of the intestinal bacterium *Escherichia coli* are capable of forming certain toxins (verotoxins, synonymous with shiga-like toxins). These verocytotoxigenic *E. coli* (VTEC) can cause serious, bloody diarrhoea in people. Haemolytic uraemic syndrome (HUS) may occur as a serious but rare complication. Infection occurs easily because the minimum infectious dose is low. Typical sources of infection for people are inadequately heated beef, lamb or goat meat, unpasteurised dairy products, sprouted vegetables, and water which has been contaminated with faeces. Ruminants are the main pathogen reservoir.

2.4.1 Mandatory reporting and case numbers in humans

Cases of VTEC in humans detected in the laboratory must be reported; the doctor providing treatment must report the clinical findings. Laboratories and doctors are required to report instances in which several cases occur at the same time in the same place – e.g. in the form of food-borne infections (FDHA Ordinance on Reporting Observations of Contagious Diseases in Humans, 818.101.126).

A total of 696 cases of VTEC that had been confirmed by laboratory diagnosis were reported to the FOPH in 2017 (previous year: 463 cases). This represents a further increase of 50% compared with the previous year (Figure VT—1). The reporting rate of 8.2 new infections per 100,000 inhabitants is the highest since mandatory reporting was introduced in 1999. As in the previous year, most cases were registered in the third quarter. The age group of children under five continued to show the highest reporting rate with 16.0 cases per 100,000 inhabitants and accounted for 10% of the VTEC cases reported. The proportion of adults (over the age of 15) has increased continuously in recent years and in 2016 stood at 82%. In particular, the rate reported among people aged over 64 increased at 13.2 per 100,000 inhabitants. Women were affected slightly more than men in nearly all age groups apart from children under 5 and adults over 64. A total of 390 cases were reported in women (56%) and 306 cases in men (44%). The cases occurred throughout Switzerland. A country in which exposure might have occurred was stated in 437 cases (63%), with Switzerland being mentioned in 280 cases (64%). Details of the serogroup were available for 94 cases (13%). The most commonly detected serogroups were: O103 and O91 (9 cases each), O80 (7 cases), O26 (5 cases) and O145 and O157 (4 cases each).

The number of HUS cases reported in 2017 remained stable at 19. Children under 5 (7 cases) and adults over 64 (8 cases) were particularly affected.
2.4.2 Duty to report and monitoring of livestock

Detection in livestock does not have to be reported as it does not cause illness in animals. However, data on the occurrence of VTEC have been gathered in various studies.

Monitoring in farm animals: VTEC is frequently detected in young cattle. In 2012, 417 of 563 stool samples (74%) taken from young cattle at the slaughtering facility tested positive for VTEC (polymerase chain reaction (PCR) testing; 42% O145, 26% O103, 24% O26, 8% O157 and 1% O111). In total, however, only 17 O26, 28 O145 and 12 O157 strains were isolated. Nine of the 17 O26 strains, 4 of the 28 O145 strains and 5 of the 12 O157 strains were vtx-positive (Hofer et al., 2013).

In 2008, rabbits earmarked for slaughter were also tested for VTEC, which was detected in 3% of the stool samples. Consequently, rabbits may also be a source of carcass contamination (Kohler et al., 2008).

Monitoring in wild animals: 239 stool samples from wild ruminants were analysed in 2011. Of these, 32.6% tested positive for the vtx gene, 6.7% for the intimin gene and 13.8% for both. A total of 56 strains were isolated, and 44.6% possessed genes for the Vtx2 group, 30.4% for the Vtx1 group, and 21.4% for both. The 56 VTEC strains came from red deer (18), roe deer (19), chamois (13) and ibex (6) (Obwegeser et al., 2012).

In 2007/08, wild boar from the canton of Geneva were tested as a reservoir for VTEC. VTEC was detected in the tonsils of 14 of the 153 (9%) wild boar tested using PCR. However, stool samples from 73 wild boar all tested negative. This means that wild boar tend more to be carriers of VTEC, but do not secrete it (Wacheck et al., 2010).
2.4.3  VTEC monitoring in food

Monitoring in dairy products: A study carried out in 2017 at the Institute of Food Safety and Hygiene at the University of Zurich (ILS) found STEC in 2% of the 51 samples of unpasteurised cheese tested and in 1.9% of the tested raw meat products (Spöerry Serrano, N. et al. 2017). In 2015/2016, the Institute for Food Sciences (IFS) at Agroscope screened random samples of Swiss cheeses made from raw milk or milk heated to only a low temperature for various pathogens. All 919 samples (2015: 844; 2016: 75) were negative for STEC.

In the National Testing Programme for Dairy Products from 2006 to 2008, 1,422 samples of semi-hard and soft cheese were tested, with STEC detected in 24 and five samples respectively (2%). All of them were non-O157 serotypes (13 isolates were assigned to O2, O22 and O91). Nine isolates carried the hlyA gene, although all isolates tested negative for the eae gene.

Monitoring in foods of plant origin: No STEC were found in 70 samples tested in a study carried out by the ILS in 2017 on bacterial contamination of fresh herbs from Switzerland and abroad. Following the incident in Germany in 2011 in which people were infected with STEC after eating sprouts, 233 foods of plant origin were tested for STEC in Switzerland in 2012 (142 samples of leaf lettuce, 64 of cut fruit, and 27 of sprouted vegetables). STEC with the virulence profile of a low pathogenic strain was detected in one of the 233 samples.

2.4.4  Measures / Prevention

The Hygiene Ordinance defines limits for E. coli in a variety of foods. Specific limits are set for VTEC in sprouts. If these values are exceeded, the cantonal chemists must report this to the FSVO. The foods affected are confiscated and destroyed. Depending on the situation, products may also be recalled and the public may be warned against eating these products.

The packaging of minced meat, meat products made from poultry and meat preparations (particularly those containing mechanically separated meat) must bear information stating explicitly that these products must be heated through thoroughly before consumption (Ordinance on Foodstuffs of Animal Origin, Art. 10).

2.4.5  Assessment of the situation

Because of the low infectious dose (< 100 micro-organisms), infections with VTEC can occur very easily through contaminated food or water that is contaminated with faeces. Multiplex PCR systems are increasingly being used to investigate diarrhoeal diseases. They enable a wide variety of bacteria, viruses and parasites to be investigated at the same time. The main cause of the observed increase is assumed to be that more testing for VTEC is being done, leading to more cases being identified. The fact that the number of cases of HUS has remained virtually constant supports this hypothesis.

The pathogen can be inactivated by heating critical foods through (e.g. raw meat, raw milk). As a study conducted in 2011 (Peng et al., 2013) showed that VTEC was detected in semi-hard cheeses made from raw milk irrespective of the selected heating temperature (40°C or 46°C), and initial contamination of the milk was detected even after a maturing time of 16 weeks, VTEC must be considered as a risk with such products. Hygiene in slaughtering and milking is particularly important when producing foods of animal origin. The importance of foods of plant origin in VTEC infections is demonstrated by the outbreaks caused by contaminated spinach (USA in 2006) and sprouted vegetables contaminated with VTEC O104 (Germany in 2011). Good kitchen hygiene is key in avoiding illness of this kind. Plant-based foods should be washed and cross-contamination should be prevented.
2.5 Trichinellosis

Trichinellosis is caused by the threadworm *Trichinella*. Depending on the infectious dose, trichinellosis may range from asymptomatic to fatal in humans. People become infected by eating meat that has not been cooked through properly (pork, wild boar, horse meat). *Trichinella* are killed by freezing. Animals are generally asymptomatic carriers. A risk of transmission is also posed by fox cadavers, rodents, and inadequately heated slaughter and food waste.

2.5.1 Mandatory reporting and case numbers in humans

Positive laboratory identification of *Trichinella* in humans must be reported. Since 1 January 2016, the doctor administering treatment has also had to report the clinical findings (FDHA Ordinance on Reporting Observations of Contagious Diseases in Humans, 818.101.126).

Only isolated cases of trichinellosis have been reported in Switzerland since mandatory reporting was reintroduced. One confirmed case was registered in 2017 (Figure TR—1). The source of the infection is not clear and may be outside the country.

![Figure TR—1: Number of cases of trichinellosis reported in humans, 2009-2017.](Source: Federal Office of Public Health, April 2018)

2.5.2 Mandatory reporting and monitoring in animals

Trichinellosis must be reported to the authorities and is among the epizootic diseases that must be monitored (EzDO, Art. 5). In 2017, three cases of trichinellosis were reported in lynxes. In the last ten years (2008-2017), between zero and five cases have been registered per year. All cases were observed in
carnivorous wild animals (90% in lynxes, 10% in foxes and 5% in wolves, Figure TR—2). Evidence of *T. britovi* was found in each case.

![Figure TR—2: Number of cases of trichinellosis reported in animals, 2008-2017.](image)

(Source: Information system for reporting epidemics (InfoSM), FSVO, March 2018)

A *study in wild animals* conducted between 1999 and 2007 found that 15 out of 55 lynxes examined (27.3%) were infected with *T. britovi*. In foxes, 21 out of 1,298 animals (1.6%) were infected in 2006/07.

Wild boar were studied more closely in 2008. Although no evidence of *Trichinella* was found in any of the 1,458 wild boar, three were found to have antibodies to *Trichinella* (seroprevalence 0.2%).

### 2.5.3 *Trichinella* monitoring in food

The carcases of horses, domestic pigs, wild boar, bears and beavers have to be examined for *Trichinella*. An exception is made for animals from small farms that produce exclusively for the local market and have obtained permission for this from the relevant canton (Ordinance on the Slaughter of Animals and Meat Inspection (SMIO), Art. 31). Packs of meat produced solely for the local market must be marked with a square symbol bearing the information “CH only” (Ordinance on Foodstuffs of Animal Origin, Art. 10).

Slightly more than 2.5 million slaughtered pigs tested negative for *Trichinella* using the artificial digestion method in 2017, corresponding to 94% of the entire population of slaughtered pigs. In horses, 2,055 animals or 89% of the entire population of slaughtered horses tested negative. In addition, 6,176 wild boars were tested and *Trichinella* was found in none of them. The number of tests carried out was on the same scale as those carried out since 2010.
2.5.4 Measures / Prevention

As this is an epizootic disease that must be monitored, no measures are generally taken with animals in the event of an epidemic. A positive finding in slaughtered animals requires the contaminated carcases to be destroyed.

2.5.5 Assessment of the situation

Trichinellosis in humans is rare and is usually attributed to infections contracted abroad or to meat products (such as raw sausages) imported from endemic regions. Based on the extensive tests that have been carried out for many years on animals slaughtered in Switzerland and the consistently negative results, it can be assumed that these animals are free from *Trichinella*. A *Trichinella* infection from Swiss pork is therefore extremely unlikely.

The risk of transmission from wild animals to the conventional domestic pig population is classed as negligible. Nonetheless, it is important to monitor wild animals and pasture pigs because the pathogen *T. britovi* occurs in lynxes, foxes and wolves in Switzerland. Wild boars have tested negative for *Trichinella* to date, but infections cannot be precluded because the study carried out in 2008 showed that wild boars may come into contact with *Trichinella*.

In one case of trichinellosis in 2012, a hunter and butcher tasted raw sausage meat containing meat from wild boars and subsequently fell ill. It remained unclear whether the wild boar was from Switzerland. The exact species of *Trichinella* also remained unclear since only one serology is usually performed in humans. This case highlights the fact that raw or insufficiently heated (pork) meat should not be eaten.

2.6 (Bovine) tuberculosis

Tuberculosis is caused by various species of mycobacteria, most commonly *Mycobacterium tuberculosis*. Transmission is usually airborne from human to human. Mycobacteria can persist in the body for decades without making the person ill. Only about 10% of those infected become ill, usually within a few months but sometimes not until several decades after infection. The transmission of *M. bovis* through the unpasteurised milk of infected cattle plays an insignificant role. Bovine tuberculosis has accounted for no more than 2% of annual cases of tuberculosis in humans for many years.

2.6.1 Mandatory reporting and case numbers in humans

Laboratories and doctors must report cases of tuberculosis in humans. A report on the course of the therapy must also be submitted after 12 to 24 months. Laboratories and doctors are also required to report instances in which several cases occur at the same time in the same place – e.g. in the form of food poisoning (FDHA Ordinance on Reporting Observations of Contagious Diseases in Humans, 818.101.126).

Of the 551 cases of tuberculosis reported in 2017, 458 were confirmed by laboratory diagnosis: *M. tuberculosis* (380 cases), *M. bovis* (3), *M. africanum* (3), *M. caprae* (0) and *M. tuberculosis* complex (114). Consequently, bovine tuberculosis accounted for less than 1% of the cases. This was within the same range as in previous years, with the exception of 2011, when 13 cases were recorded (Figure TB—1). All three cases involving *M. bovis* came from Switzerland. All the people affected were aged over 80.
2.6.2 Mandatory reporting and monitoring in animals

Tuberculosis in animals must be reported to the authorities and is one of the epizootic diseases that must be eradicated (EzDO, Art. 3 and Art. 158-165). Tuberculosis is present if there is evidence of *M. bovis*, *M. caprae* or *M. tuberculosis* or if the tuberculin skin test shows a positive result in an animal from a population in which tuberculosis has already been detected. The incubation period is 150 days.

Switzerland is recognised as being free from tuberculosis in livestock. Individual cases may, however, occur without the tuberculosis-free status being affected. This freedom was most recently demonstrated in a study carried out in 1997. In a random sample of 10% of farms (N = 4,874), a total of 111,394 cattle showed a negative result in a tuberculin skin test. All samples were negative. The most recent cases in cattle occurred in 2013/14, and before that in 1998. Because of the low number of cases, Switzerland’s tuberculosis-free status was not impaired.

Tuberculosis-like lesions on cattle are examined in more detail at the slaughtering facility. Good monitoring is a challenge in a tuberculosis-free country in which meat inspectors and checkers have little training in recognising such cases. The LyMON (lymph node monitoring in cattle in slaughtering facilities) project was set up in autumn 2013 after the first cases were discovered in cattle. A handbook, *Forms of tuberculosis in meat inspection*, was made available to all meat inspectors and controllers. These people regularly send lymphatics tissue with non-specific changes to the national reference laboratory for examination.

In 2017, 108 samples from cattle were sent in and examined using Ziehl-Neelsen staining and PCR. All samples were negative for *M. tuberculosis* complex (see also LyMON early detection programme, annual report 2017). A tuberculosis monitoring programme for game in eastern Switzerland and the Duchy of Liechtenstein has also been in place since 2014. Lymph nodes and organs with isolated changes from 237

![Figure TB—1: Number of cases of tuberculosis reported in humans, 2008-2017.](source)

(Source: Federal Office of Public Health, April 2018)
wild animals were examined in 2017. A total of 211 red deer representing a random sample of healthy red deer that had been shot underwent diagnosis. Nineteen red deer, four roe deer, two ibexes and one chamois goat were collected as part of the risk-based monitoring of sick and conspicuous game. All samples from the wild animals were also negative for *M. tuberculosis* complex (see also tuberculosis monitoring programme for game in eastern Switzerland and the Duchy of Liechtenstein, final report 2017.

One case of tuberculosis in a cat (positive for *M. tuberculosis* complex) was registered in the epizootic diseases reporting information system in 2017. This corresponds to the situation in the past ten years (2008–2017), in which isolated cases have occurred in cats (six), dogs (one), horses (one), llamas (one) and elephants (one) (Figure TB—2). The situation was different in 2013 and 2014, when rare outbreaks of tuberculosis were recorded in cattle in the recognised free livestock population.

![Tuberculosis in animals](image)

**Figure TB—2**: Number of cases of tuberculosis reported in animals, 2008-2017.

(Source: Information system for reporting epidemics (InfoSM), FSVO, March 2018)

### 2.6.3 Measures / Prevention

**Food-borne transmission**: Large numbers of germs (several million bacteria in adults) are required to transmit bovine tuberculosis to humans through food. Often only a few animals are affected within a herd, and only a few of the infected cows have lesions on their udders and excrete the pathogen into their milk. The germs are diluted when their milk is mixed with milk that is not affected. Moreover, *M. bovis* cannot multiply in the milk. Nonetheless, raw milk and raw cream are not intended for direct consumption and must be heated to at least 70°C before they can be consumed. Pasteurisation or heat treatment at a high temperature – e.g. high-temperature pasteurisation or UHT treatment – eliminates *M. bovis*.

**Air-borne transmission**: When transmitted via the air (airborne), even a few pathogens can lead to an infection, which means that infections caused by droplets may occur. However, since the majority of Swiss cattle are free from tuberculosis, direct transmission from cattle to humans is not likely.
The measures that need to be taken if cattle are infected with *M. bovis*, *M. caprae* and *M. tuberculosis* are regulated in the EzDO, Art. 158-165. If there is a suspected epizootic event or contagion and if any such event occurs, the transportation of animals must be stopped at the farm concerned and the herds must be epidemiologically investigated. In the event of an epidemic, all animals suspected of being infected at the facility must be slaughtered and contaminated animals must be killed. The milk of contaminated animals or animals that are suspected of being infected must be disposed of. At most, it can be boiled and used as animal feed in the same facility. Stables must be cleaned and disinfected. One year after an epizootic event, all cattle at this farm that are older than six weeks must undergo a follow-up inspection.

### 2.6.4 Assessment of the situation

Between 500 and 650 people contract tuberculosis in Switzerland each year, usually a form that is easily treatable. Tuberculosis caused by *M. bovis* is rare in humans. Since 2005, no more than 15 cases have been reported per year. This represents fewer than 2% of all reported cases. Most of the people affected in Switzerland are native to Switzerland and over 65 years of age. In most cases, these people became infected in childhood, when cattle herds were still severely affected by this disease.

The Swiss cattle population has been free from tuberculosis for many years. However, isolated cases can occur. The risk of becoming infected with tuberculosis in Switzerland is low.

Risk factors for the import of tuberculosis include international trade, cattle pastured in high-risk alpine areas and wild animals near the borders with Austria and Germany. The outbreaks of *M. caprae* in eastern Switzerland in 2013/2014 show that summer pasturing in Tyrol and Vorarlberg, where *M. caprae* is endemic in the red deer population, is a source of infection for Swiss cattle. The cause of the outbreak of *M. bovis* in 2013, on the other hand, was never clarified.

There appears to have been an increase in cases of tuberculosis in the EU in recent years (e.g. in the UK, France, Italy, Spain and Portugal). Wild animals have been identified as a possible reservoir in all these countries, particularly in regions with a high density of wild animals. Caution is therefore required when importing cattle into Switzerland, particularly from countries with high numbers of cases. Anyone who keeps or cares for animals must report any suspicious cases to their vet. Meat monitoring at slaughtering facilities, which is regulated by law, is a central element in the early identification and monitoring of tuberculosis.

### 2.7 Brucellosis

Brucellosis is caused by an infection with *Brucella* bacteria. Humans become infected through secretions from infected animals or through consumption of contaminated, unpasteurised milk. Transmission from human to human is very rare. The symptoms are varied, including fever, headaches and gastrointestinal problems.

In the animal kingdom, *Brucella* affects cattle, sheep, goats, pigs, horses, dogs and other species. Brucellosis manifests in animals in the form of contagious late abortions in the last third of gestation, inflammation of the testes and epididymis and subsequent fertility disorders. In many cases, however, there are no clinical symptoms. Infected animals secrete the pathogen mainly through their sex organs and mammary glands.
2.7.1 Mandatory reporting and case numbers in humans

Laboratories are required to report brucellosis infections in humans (FDHA Ordinance on Reporting Observations of Contagious Diseases in Humans, 818.101.126).

A total of nine cases of brucellosis that had been confirmed by laboratory diagnosis were reported to the FOPH in 2017. The figure for the previous year was seven cases. These affected seven men and two women aged between 34 and 65 years. The pathogen was differentiated in only one case, in which *B. melitensis* was identified. The number of human cases has been low for many years, and in the last ten years has fluctuated between one and 14 cases per year (Figure BR—1).

![Figure BR—1: Number of cases of brucellosis reported in humans, 2008–2017.](source)

(Source: Federal Office of Public Health, April 2018)

2.7.2 Mandatory reporting and monitoring in animals

Brucellosis in cattle, sheep, goats, pigs and rams is subject to mandatory reporting. It is among the epizootic diseases that must be eradicated (cattle, sheep, goats, pigs; EzDO, Art. 3) or controlled (rams; EzDO, Art. 4). Abortions in ungulates must also be reported. If there is a cluster of abortions, these must be investigated (EzDO, Art. 129).

Switzerland is free from brucellosis in cattle, sheep and goats. The last case of *B. abortus* in cattle occurred in 1996, while the last case of *B. melitensis* in small ruminants was in 1985. The cattle population was documented as free from the disease in 1997, when a random sample of 139,655 cows (over 24 months old) from 4,874 farms underwent serological testing in 31,042 blood samples and 18,952 bulk-milk samples and showed negative results. No cases in cattle have been reported since then. Freedom from disease in the sheep and goat populations has been documented each year since 1998 through the testing of samples. In 2017, 494 sheep farms (6,788 blood samples) and 743 goat farms (7,375 blood samples) tested negative for *B. melitensis* (for more information see reports on monitoring of epizootic diseases).
No cases of brucellosis were reported in animals in 2017. In the last ten years (2008–2017), five cases of brucellosis have been registered. On three woolly pig farms (2009) and in one wild boar (2010), these involved an infection with *B. suis* serovar 2. *B. suis* biovar 2 is known to occur in wild boar in Switzerland (Leuenberger *et al.*., 2007). However, the pigs infected in 2009 had different wild boar isolates, meaning that direct transmission through wild boar was unlikely (Abril *et al.*, 2011). The first clinical case of brucellosis in rams in nine years was registered in 2010 (a ram infected with *B. ovis*). Brucellosis in rams occurred in particular between 1994 and 2001. A total of 101 cases were reported during this period, between one and 34 cases per year.

2.7.3 **Measures / Prevention**

The measures for cattle (*B. abortus*) are regulated in Art. 150–157 of the EzDO, while those for sheep and goats (*B. melitensis*) are regulated in Art. 190–195, those for pigs (*B. suis, B. abortus and B. melitensis*) in Art. 207–211 and those for rams (*B. ovis*) in Art. 233–236.

2.7.4 **Assessment of the situation**

There are few reported cases of brucellosis in humans in Switzerland. Infections can usually be traced back to stays abroad or to the consumption of foreign dairy products. Swiss livestock that supply milk are free from brucellosis, and there are no indications from monitoring data that this status is at risk. Raw milk in this country is therefore safe with regard to *Brucella*. Nevertheless, raw milk is not a ready-to-drink product and must be heated to at least 70°C before consumption.

The outbreak of *B. suis* in woolly pigs in the canton of Geneva in 2009 shows that epizootic diseases that have not been diagnosed for years can recur at any time. The transportation of animals is a major factor here.

*B. suis* serovar 2 is found in wild boars (Wu *et al.*, 2011). Pigs kept on open land are at particular risk, as are those kept less than 50 metres away from woods and with fences lower than 60 cm along the Jura mountain range and in the Swiss Plateau, where the density of wild boar is particularly high. *B. suis* biovar 2 is, however, less virulent to humans than biovar 1 and 3 and is rarely detected in humans.

2.8 **Echinococcosis**

Echinococcosis is an infection with tapeworms of the genus *Echinococcus* or their larval stages. A distinction is made between alveolar echinococcosis (AE, in which the pathogen is *E. multilocularis*) and cystic echinococcosis (CE, in which the pathogen is *E. granulosus sensu lato*). Humans are a dead-end host in both cases.

In AE, humans are infected with worm eggs either from contaminated hands that have been in direct contact with infected animals (foxes, dogs, cats) or by handling contaminated soil. Humans can also be infected by contaminated food (e.g. raw vegetables, berries, mushrooms) or drinking water. The larvae accumulate in the liver, in particular, and less frequently in other organs. The clinical picture of echinococcosis is determined by the organs affected. Cysts develop and impair the functioning of the organs. Symptoms often do not occur until months or years after infection.

Dogs are the dead-end host for CE. They are infected by ingesting bladder worms, which can occur in the organs of animals for slaughter. *Echinococcus granulosus sensu lato* is no longer really found in
Switzerland. There are sporadic imported cases in humans and animals (particularly dogs, cattle and sheep).

2.8.1 Mandatory reporting and case numbers in humans

There has been no requirement to report the occurrence of *Echinococcus spp.* in humans since 1999. However, the Swiss Federal Statistical Office (FSO) has figures showing how many people have been hospitalised for the first time with AE every year. The most recent figures date from 2016.

The number of people hospitalised has been showing an upward trend in recent years, from 25 in 2008 to 51 in 2016. This corresponds to an increase in the rate of initial hospitalisation from 0.22 to 0.6 cases per 100,000 inhabitants, and is a new record.

2.8.2 Mandatory reporting and monitoring in animals

Echinoccosis in animals is an epizootic disease that must be monitored (EzDO, Art. 5). A total of 92 cases were reported in 2017. These involved 89 slaughtered pigs, one monkey, one night monkey and one beaver. In the last ten years (2008–2017), the number of cases has fluctuated between one and ten per year. After pigs, the animals most frequently affected were dogs and foxes. The persistently marked increase since 2016 is due to reporting on pigs for slaughter in which *E. multilocularis* has been detected (Figure EC—1). This is the result of a research project. Organs with pathogenic changes of parasitic origin (e.g. *Echinococcus*) may not be consumed (FDHA Ordinance on Hygiene in the Slaughter of Animals). They are removed during meat inspections without laboratory analysis normally being performed. However, if samples are sent to the laboratory and *Echinococcus* is identified, this is defined by the EzDO as an epizootic event subject to mandatory reporting. In previous years there have been cases in pigs, and there was also one bovine case in 2012 which was discovered during a meat inspection. The situation was unchanged in 2017 apart from a higher number of inspections and reports concerning pigs as the result of the research project.

Foxes are the main host of *E. multilocularis*. The prevalence in foxes is estimated at 30–70%. A small study carried out at the Institute of Parasitology at the University of Zurich in 2016/2017 examined 280 foxes that had been killed in the greater Zurich area (2017: 201, 2016: 79). Of these animals, 113 (40%) were positive for *E. multilocularis* (2017: 93, 2016: 20). In 2012 and 2013, 53% and 57% respectively (2012: 105 out of 200, 2013: 57 out of 100) of the hunted foxes originating from eastern Switzerland tested positive for *E. multilocularis*.

Monitoring studies performed by the Institute of Parasitology at the University of Zurich in mice from the greater Zurich area in 2007 and 2008 showed that 17% of the animals were infected with *E. multilocularis* (2007: 100 out of 634, 2008: 66 out of 393). In 2013, barely any mice were infected with *E. multilocularis* (3 out of 200 with *A. scherman* and 6 out of 259 with *M. arvalis*).
Figure EC—1: Number of cases of echinococcosis reported in animals, 2008–2017.

(Source: Information system for reporting epidemics (InfoSM), FSVO, March 2018)

2.8.3 Measures

As this is an epizootic disease that must be monitored, no government measures are taken with animals in the event of an epidemic.

Forest fruits such as berries and mushrooms and any vegetables and fallen fruit must be thoroughly washed and if possible cooked before eating. Normal freezing at −20° C will not kill off the eggs of *E. multilocularis*.

2.8.4 Assessment of the situation

Cases of AE are rare, although the risk of an infection has increased slightly in the last few years. AE is a disease that severely impairs the quality of life. However, treatment options have improved significantly in the last 40 years. The average life expectancy of people infected with AE is around two to four years lower than for the population as a whole. In many cases, people make a full recovery. Further monitoring of the epidemiological situation will continue to be important over the next few years.

The increased risk of infection is thought to be due to the fact that there are more foxes around – following the success in controlling rabies in the 1980s and as a result of less fox hunting. At the same time, foxes are increasingly moving into urban areas, and it can be assumed that this situation will persist. *E. multilocularis* is increasingly being detected in densely populated areas. Here the fox density is frequently high at more than ten mature foxes per square kilometre. This is due to the abundant food supply in the form of food waste in compost heaps, the wide availability of berries and fruit and deliberate feeding by residents. The population has also become increasingly tolerant of foxes. Since important intermediate hosts such as water voles (*A. scherman*) and field mice (*M. arvalis*) are common on the periphery of towns,
the parasite can find optimum living conditions here. There is therefore presumably a high level of environmental contamination with eggs of the fox tapeworm at the transition from the urban to the rural habitat. Infections can be significantly reduced by deworming foxes. In 2007/08, the Institute of Parasitology at the University of Zurich showed that deworming foxes reduced the proportion of *E. multilocularis*-positive fox droppings from 25% (361 out of 1,376) to 19% (202 out of 1,044). If the foxes were not dewormed, the proportion of *E. multilocularis*-positive droppings remained constant at 25% (63 out of 254). However, the beneficial effect of deworming does not last long, and densely populated areas should therefore be given priority in efforts to control the fox tapeworm. Deworming is an expensive process since bait needs to be set out regularly over an extended period. The focus, therefore, is currently on maintaining public awareness of individual preventive measures (e.g. hand hygiene after working in the garden, washing field crops and garden fruits that are to be consumed raw, changing shoes before entering living areas, not feeding or taming foxes).

Dogs and cats that hunt mice should be dewormed every month. In addition, dog faeces should be consistently removed from residential areas. If foxes are found dead or killed in a hunt, they should be handled with plastic gloves and the hands should then be washed thoroughly. Dogs that have been in foxes' dens should be thoroughly showered (see also www.paras.uzh.ch/infos and www.ESCCAP.ch).

Like humans, pigs are also a dead-end host for *E. multilocularis*. Infected pigs therefore pose no risk to humans. A one-year research project that kicked off in 2017 is aiming to assess environmental contamination with *E. multilocularis* by examining pig livers from slaughtering facilities.

Infections with *E. granulosus* are rare in Switzerland. Dogs imported into Switzerland should be treated for tapeworms immediately before they enter the country since many areas of other countries are infested with *E. granulosus* (e.g. southern and north-eastern Europe). Abattoir waste should only be fed to dogs if it has been cooked or frozen to at least –18°C for three days.

### 2.9 Q fever (coxiellosis)

Q fever is an acute illness caused by infection with the bacterium *Coxiella burnetii*. The natural reservoirs of the pathogen are cattle, sheep, goats, dogs, cats, some wild animals and ticks. Infected animals often show no symptoms but excrete the pathogen in their faeces, urine or milk. Birthing products of livestock (e.g. placenta), in particular, can be highly infectious. Most cases of infection in humans are due to inhaling dust containing pathogens or by direct contact with infected animals.

In around half of those infected, the pathogen causes mild, flu-like symptoms that regress spontaneously, or none at all. The other half develop abrupt fever, chills, profuse sweating, fatigue and headache that may be complicated by inflammation of the lungs, liver, heart muscle or brain. Q fever is usually treated with antibiotics to prevent the illness from becoming chronic. Sporadic cases may occur, as may outbreaks.

#### 2.9.1 Mandatory reporting and case numbers in humans

Diagnostic laboratories have been required to report positive laboratory results for *C. burnetii*, the causative agent in Q fever (coxiellosis), in humans again since the end of 2012 (*FDHA Ordinance on Reporting Observations of Contagious Diseases in Humans, 818.101.126*).

A total of 42 cases of Q fever were reported to the FOPH in 2017, corresponding to a reporting rate of 0.5 new infections per 100,000 inhabitants. The figure for 2016 was 47 cases, corresponding to a rate of 0.6 new infections per 100,000 inhabitants. This means that the case numbers have remained stable (Figure
CO—1). There is no evident seasonal trend. The highest reporting rate was found in men over 64 years of age (2.1 per 100,000). There were no cases reported in the under-15 age group. As in previous years, more men (N=33) than women (N=9) were affected. There were no recorded outbreaks.

The most recent outbreak occurred in 2012, when 17 people fell ill in the canton of Vaud, ten of whom had to be hospitalised. An infected herd of sheep was identified as the definite source of infection in 12 of these cases. Mandatory reporting was reintroduced as a result of this outbreak; it had been discontinued in 1999 because the case numbers had declined since 1991. Between 1989 and 1991 there were between 32 and 52 cases annually.

The largest known outbreak in Switzerland to date occurred in 1983, when more than 400 people fell ill. The infection was due to 12 flocks of sheep that had excreted *C. burnetii* on the way down from their alpine pasture.

![Figure CO—1: Number of cases of Q fever reported in humans, 2013–2017.](Source: Federal Office of Public Health, April 2018)

2.9.2 **Mandatory reporting and monitoring in animals**

Coxeilliosis in animals is subject to mandatory reporting. A total of 113 cases were recorded in the epizootic diseases reporting information system in 2017, confirming the upward trend that began in 2015. In 2017 the case numbers reached the level recorded in the early 1990s, when over 100 cases were reported annually. Following a decline to approx. 40 cases annually in the period from 1996 to 2005, the number of cases has not fallen below 60 per year since 2006.

In the last ten years (2008–2017), an average of 80 cases have been registered annually (min: 58, max: 113). Cattle were most frequently affected (84%), followed by goats (11%) and sheep (5%) (Figure CO—2).
2.9.3 Monitoring in food

PCR was used to investigate a number of foods – among them milk from cows, sheep and goats, and egg shells – for *C. burnetii* in the period from 2005–2006. *C. burnetii* was found in 4.7% of the 359 samples of bulk milk obtained from cows. The positive samples originated from 8 of the 27 animal facilities tested (30%). Negative results were obtained with 504 egg shells, 81 samples of sheep milk and 39 samples of goat milk.

A more detailed study performed in 2007 found that 49.5% of the 872 samples of bulk milk tested were positive. Each of the bulk-milk samples originated from a different facility. The study used a new PCR method with high sensitivity. The prevalence in bulk-milk samples was thus estimated at 30%–50% in 2007.

2.9.4 Measures / Prevention

There is a need to increase awareness of the existence of this disease and the ways in which infection can be avoided. Animal keepers must report abortions in cattle after the first third of gestation and all abortions in sheep or goats to their veterinarian. If more than one animal aborts at a facility within a four-month period, abortion material must be sent to a laboratory for investigation for abortion-inducing pathogens. If only one animal aborts on a livestock dealer’s premises or during alpine pasturing, investigation for abortion-inducing pathogens is mandatory.

In some countries, a vaccine is available for people who work in laboratories that handle bacteria or who may come into contact with potentially infected animals (e.g. veterinarians, slaughtering facility personnel); this vaccine is not currently authorised for use in Switzerland.
2.9.5 Assessment of the situation

Around 40 to 60 cases are reported in humans annually. People are infected mainly by inhaling dust that contains pathogens, and people in close contact with animals (veterinarians, animal keepers, slaughtering facility personnel, etc.) are particularly affected. It is, however, possible to avoid infection by adopting appropriate hygiene measures, e.g. wearing a protective mask and thorough hand washing after contact with animals, excrement or abortion material.

The number of *C. burnetii*-associated abortions in animals is low. Cattle are still the animals most frequently affected, although in the past two years a growing number of cases in small ruminants, and goats in particular, have been reported. Infected sheep and goats are considered to pose a greater risk to humans than infected cattle.

2.10 Tularaemia

Tularaemia, also known as rabbit fever, is an infectious disease caused by the bacterium *Francisella tularensis*. The less dangerous subspecies *F. tularensis* subsp. *holarctica* is widespread in Europe and Switzerland. The bacterium infects various small mammals, particularly wild hares, rabbits and rodents such as mice, rats and squirrels. It also occurs in the environment, for example in water and soil. The infection is usually transmitted to other animals or to people in tick or insect bites, by direct contact with a contaminated environment or sick animals (e.g. while hunting, skinning or slaughtering), while examining infected samples in laboratories, while eating inadequately heated meat from infected animals and by swallowing or inhaling contaminated water and dust (e.g. hay, soil). A few pathogens are sufficient to cause an infection.

Irrespective of the transmission route, the organs affected and the subspecies of pathogen, tularaemia can take a very variable course in humans. The infection manifests in the form of symptoms such as fever, progressive inflammation of the portal of entry and lymph node swelling. The course is fatal in under one per cent of cases. Tularaemia responds well to antibiotics when diagnosed promptly. Antibiotic therapy can reduce the mortality rate even further.

Rodents of all types, hares and rabbits are highly susceptible and infection in these animals takes a serious course with fever, apathy and shortness of breath (dyspnoea). Death occurs one to two weeks after infection. Milder forms are characterised merely by local lymph node swelling.

2.10.1 Mandatory reporting and case numbers in humans

Positive results of laboratory testing in humans have been subject to mandatory reporting since 2004. The doctor administering treatment is required to report the clinical findings (*FDHA Ordinance on Reporting Observations of Contagious Diseases in Humans, 818.101.126*).

If a laboratory reports a positive finding, the doctor making the diagnosis must subsequently submit a report on the clinical findings.

In 2017, 131 cases were reported (1.5 cases per 100,000 inhabitants). This means that the number of cases has more than doubled since 2016. The cases involved 84 men and 47 women aged between 1 and 88 years. Half of them were over 49. Most cases were reported in the cantons of Zurich, Bern and St. Gallen. Tick bites were the source of infection in most cases (2012: 9/40 cases; 2013: 19/29; 2014: 7/39; 2015: 16/50; 2016: 21/55, 2017: 33/131). Until 2011, no more than 10 cases had been reported annually.
(Figure TU—1). More information is provided in articles in the FOPH Bulletin “Tularaemia: The spread of a rare, tick-borne disease” and “Tularaemia in Switzerland: An overview of the pathogen and the disease and an analysis using the reporting data from 2004 to 2012”.

![Tularaemia in humans](image)

**Figure TU—1**: Number of cases of tularaemia reported in humans, 2008–2017.

(Source: Federal Office of Public Health, April 2018)

Tick bites are the main source of infection. Molecular biological analysis shows that the prevalence of ticks (*Ixodes ricinus*) infected with *F. tularensis* in Switzerland is no more than approx. 0.01‰ in total. Regions with an above-average contamination rate have been identified that correlate with elevated local reporting rates for human cases. Cultivation of *F. tularensis* from infected ticks in conjunction with next-generation sequencing methods has enabled a genetic comparison to be made between ticks isolated from humans and ticks isolated from animals. A high degree of relatedness was determined, confirming the role of ticks as a vector of transmission. There is also a correlation between the clinical incidence and climatic and ecological factors that are important in maintaining the persistence of the tick population. Ticks are an indicator and a vector, but their role as a reservoir is probably only minor since there is no trans-ovarian transfer of the pathogen to the nymphs.

The biological cycle of *F. tularensis* is only partly known, but it is certainly complex and regionally varied. It was shown in a study performed throughout Europe (Dwibedi et al. 2016) that Switzerland has the greatest genetic diversity in Europe. This great diversity is considered to indicate that *F. tularensis* has succeeded in persisting in Switzerland throughout a long evolutionary period. Where epidemiological issues are concerned, this great diversity also has the advantage of enabling zoonotic routes of transmission to be described in a microgeographic context (Wittwer et al. 2018).
2.10.2 Mandatory reporting and monitoring in animals

Tularaemia in animals must be reported to the authorities and is among the epizootic diseases that must be monitored (EzDO, Art. 5). Veterinarians and laboratories are required to report epizootic events and suspicions of tularaemia to the cantonal veterinary office.

Four cases of tularaemia were reported in 2017, which is about the same number as in previous years. In the last ten years (2008–2017), the number of cases has fluctuated between one and nine per year. 86% of the cases involved hares, 12% involved monkeys (Figure TU—2).

![Figure TU—2: Number of cases of tularaemia reported in animals, 2008–2017.](Source: Information system for reporting epidemics (InfoSM), FSVO, March 2018)

Between 2012 and 2014, a total of 28 hares, 24 mice, 2 monkeys and 1 stone marten tested positive for *F. tularensis* in a research project carried out at the University of Bern. Not all these cases were reported to the veterinary authorities, and this explains the discrepancy with Figure TU—2.

In 2012 tularaemia was also identified in wild mice able to enter and leave an animal housing building used for research in the canton of Zurich. There were no reported cases of infection in the research scientists or in people in the immediate vicinity of the building.

2.10.3 Measures / Prevention

There is no vaccine against tularaemia available either in Switzerland or in other western countries. A vaccine is available in Russia that produces only mild side effects and evidently confers a certain level of protection. It is important to adopt adequate protective measures against ticks in the open air since roughly 30% to 40% of human cases are the result of tick-borne transmission. This means wearing clothes that cover the body when spending time in woods, using a tick repellent spray and checking systematically for...
tick bites once at home. The tick app provides a risk map showing the areas where there currently a risk of getting bitten by ticks and advice on the correct way to remove ticks. Contact with dead and sick wild animals should be avoided.

2.10.4 Assessment of the situation

Tularaemia occurs throughout the northern hemisphere. The routes of exposure to tularaemia can be very varied. The number of cases reported in Switzerland remains low, although there has been a substantial increase in recent years. The reasons for this increase are not known but it is probably due at least in part to greater awareness among the medical profession.

In the animal kingdom, tularaemia affects mainly hares, but also rodents and zoo animals. Game keepers, hunters, people working in agriculture and forestry, people working in laboratories and veterinarians are therefore at greater risk of infection.

It is difficult to get people to send dead animals they find or kill to a laboratory voluntarily. The only conclusion that can be drawn from the available data is therefore that tularaemia is present in the hare population in Switzerland. The prevalence is unfortunately not known.

2.11 West Nile fever (WNF)

West Nile fever (WNF) is a viral disease that occurs in humans, birds, horses and other mammals. It can be transmitted in the bite of an infected mosquito. Around 80% of humans infected with WNV have no symptoms. Otherwise the symptoms are generally mild, and in approx. 1% of cases WNV affects the nervous system, leading to inflammation of the brain and/or meningitis. Wild birds are usually asymptomatic carriers of WNV and play a major role in the circulation of the virus. Horses, on the other hand, play no role in the spread of WNV. Horses generally display no symptoms either, although they may also develop an inflammation of the brain associated with a high fever.

2.11.1 Mandatory reporting and case numbers in humans

Laboratories have been required to notify the authorities of any incidences of West Nile Virus in humans since 2006 (FDHA Ordinance on Reporting Observations of Contagious Diseases in Humans, 818.101.126). WNF should be excluded by differential diagnosis in patients with conditions affecting the central nervous system or flu-like symptoms with no known cause.

in Switzerland, there have so far been no home-grown cases of WNF, i.e. people who became infected with WNV while in Switzerland. Since 2010, there have been isolated reports of imported cases in which those involved became infected with WNV abroad: one case in each of 2010, 2012 and 2013. These people had previously spent time in Egypt, Kosovo or Croatia.

2.11.2 Mandatory reporting and monitoring in animals

West Nile fever in animals has been notifiable since 2011. Anyone who keeps or cares for animals must report any suspicious cases to their vet. So far no cases of WNF have been found in animals in Switzerland.

Bird monitoring: Since 2012, no more than six dead wild birds have been screened each year. The result was negative in all cases (2017: 5; 2016: 4; 2015: 7; 2014: 4; 2013: 1; 2012: 2).

A research project carried out between 2014 and 2017 at the National Reference Centre for Poultry and Rabbit Diseases (NRGK) tested samples from the brains of 432 wild birds (2016: 130, 2015: 67, 2014: 235) using RT-qPCR that were negative for WNV. In addition, 1,455 blood samples from the Avian Influenza Monitoring programme (see Report on monitoring of epizootic diseases) tested negative for WNV antibodies. These originated from flocks of free-range laying hens (2017: 349; 2016: 111; 2015: 894) and flocks of fattening turkeys (2017: 101). Samples from birds in zoos (2015: 23) and from 45 backyard chickens, seven quails, one guinea-fowl and one black swan (2106) all tested negatively.

Between 2013 and 2016, mallards in the Austrian sentinel facility used mainly to monitor avian influenza were also tested for WNV antibodies at the end of each year. No WNV antibodies were detected in 2016, 2014 and 2013. There are no results for 2015 as not enough material was available for sampling purposes. The sentinel facility was taken out of operation in 2017.

Mosquito monitoring: A research project carried out from 2014 to 2015 (collaboration between the Laboratory of Applied Microbiology at SUPSI, Spiez Laboratory and the Swiss Institute of Tropical and Public Health) sought to optimise methods of catching and analysing mosquitoes. In 2016, approx. 1,400 mosquitoes, mainly *Aedes albopictus* and *Culex pipiens/torrentium*, were collected between July and October in the canton of Ticino. Female mosquitoes (slightly over 1,000 mosquitoes) were screened for flaviviruses and alphaviruses. No WNV was detected (personal communication, V. Guidi).

Investigations of mosquito-infested pools in the cantons of Ticino and Geneva and north of the Alps carried out between 2011 and 2013 were all negative (TI: 466 (2011), 1,429 (2012) and 605 (2013) mosquito-infested pools (*Culex, Aedes vexans* and *Aedes albopictus*); GE 62 (2011) and 214 (2012) mosquito-infested pools (only *Culex*); north of the Alps 123 mosquito-infested pools (2013: *Culex, Aedes vexans* and *Aedes albopictus*)). In the canton of Ticino, flaviriruses were detected in 36 pools (2012: 2.5 %) and five pools (2013: 0.8 %) (0.8 %), but they differed significantly from WNV.

2.11.3 Measures / Prevention

WNV should be excluded by differential laboratory diagnosis in humans and horses with conditions affecting the central nervous system or flu-like symptoms with no known cause. Wild birds (especially crows, sparrows, blackbirds and birds of prey) that are found dead should always be sent for examination to detect West Nile virus, especially if several dead birds are found in one location. If WNV is detected, the FSVO and the FOPH inform each other immediately.

Vigilance is required in the period from June to October, when mosquitoes are active. During travel to countries in which West Nile virus occurs, it is advisable to take precautions against insects in the form of appropriate clothing and insect repellents. A vaccine for horses was given regulatory approval in Switzerland in 2011.

2.11.4 Assessment of the situation

As long as there is no evidence that West Nile virus is present within Switzerland, it is assumed that Switzerland is free of WNV. It cannot be ruled out, however, that WNV is circulating in Switzerland, especially among wild birds and mosquitoes.
The Radar Bulletin published by the FSVO reports on WNF when WNF incidents relevant for Switzerland occur, particularly in neighbouring countries. The first human cases in Italy were reported in Lombardy, a region of Italy bordering on Switzerland, in 2013. The southern part of Lombardy has been classified as an endemic region since 2014. Piedmont, another region that borders Switzerland, was declared endemic in 2016. WNV-positive wild birds have been found repeatedly in the eastern part of Austria since 2012.
3 Particular incidents involving zoonotic diseases

3.1 Rabid bats

At the end of July 2017, an individual encountered a weak and confused bat in Neuchatel. The individual lifted up the bat with his bare hands and was bitten by it. The bat died shortly afterwards. The individual went to a hospital immediately and, after consulting the Swiss Rabies Centre, he was given post-exposure treatment for rabies. The bat was sent to the Rabies Centre in Bern for examination. It was confirmed that the bat had been infected with a rabies virus, specifically the European bat lyssavirus 1 which is circulating in Europe but had not previously been detected in Switzerland.

It is rare for rabies to be detected in bats in Switzerland. This has occurred four times in the past 40 years. The European bat lyssavirus 2 was detected in the cases recorded in 1992, 1993 and 2002. The current case shows that in Switzerland there is a low risk of becoming infected with rabies through contact with bats. It is important not to touch sick wild animals or those behaving abnormally. If necessary, specialists (game keepers, veterinarians) should be involved, people who know how to protect themselves when handling such animals (e.g. by wearing tough work gloves that protect against bites). Particular caution is advised when travelling to countries in which rabies is a frequent occurrence. In addition to bats, stray dogs, in particular, may pose a risk in countries with a high risk of rabies. Individuals who are bitten in one of these countries should seek medical advice without delay.

3.2 Anthrax in a dairy facility

Anthrax was found in a dairy facility in the canton of Jura in early May 2017. After a cow had been found dead in the pasture and tested positive for anthrax, the facility was placed under level 2 quarantine, the pasture was cordoned off and the movement of animals and people was restricted. The facility and the surrounding land were decontaminated by the health authorities and the animals at the facility underwent regular clinical monitoring. A few days later, a cow at the quarantined facility displayed abnormal clinical symptoms and was investigated immediately at the Institute of Animal Pathology at the Vetsuisse Faculty in Bern. It emerged that the animal was infected with *Bacillus anthracis*, the organism that causes anthrax.

Anthrax is a zoonotic disease, and *B. anthracis* can be transmitted from animals to humans. The pathogen also forms long-lived spores that can persist in the environment (in potassium- and nitrate-rich soils, for example) for decades. This complexity of the zoonotic disease led to the establishment of a multidisciplinary task force. The cantonal veterinary service, the public health service and Spiez Laboratory, the national reference centre for anthrax (NANT), were involved in implementing the measure. In order to analyse the outbreak, various water and soil samples from the potentially contaminated pasture were examined, including some from a site 2 km away at which a carcase had previously been found. Although all the analyses produced negative findings, it is quite plausible for anthrax spores at the site of the former carcase to have been washed onto the pasture and for the contaminated grass to have been eaten by the two animals that died. Appropriate measures were taken at the possible source of the infection in order to prevent further contamination of the site. The possibility of the pathogen having been transmitted to humans was excluded since testing of the veterinarians who had treated the animals (examination of nasal swabs) was negative.
Since all tests carried out on the animals from the affected facility were negative for anthrax, the quarantine was lifted in early June 2017 after all the measures had been concluded. Although anthrax was not detected in any person related to this case, the cantonal public health office is remaining vigilant.

The last case of anthrax in Switzerland was recorded in the canton of Schwyz in 1997; the most recent case in the canton of Jura was in 1993. As the recent case shows, anthrax is very rare in Switzerland. Suspicious carcasses must not be opened since the blood of dead animals contains a large quantity of bacteria that form spores in the air and can persist in the environment for decades. Former decomposition sites are epidemiologically relevant as pathogen reservoirs. Although anthrax is a zoonotic disease, humans are not very susceptible to it but may fall ill following contact with animal material contaminated with spores.
4 Food-borne disease outbreaks

Food-borne disease outbreaks are not common in Switzerland. A total of 18 food-borne disease outbreaks were reported in 2017. However, this figure is slightly higher than the figure for 2016 (11).

In 2017, the oversight authorities throughout Switzerland recorded a total of 18 outbreaks of food poisoning. More than 383 people fell ill and at least 70 were hospitalised.

It was not possible to identify the pathogen responsible for the outbreak in seven cases. Histamine in food was identified as the cause in three of the remaining eleven cases. All three cases involved fish, two of them tuna.

Three food-related outbreaks of illness were due to poor hygiene in the storage and handling of food. This led to the development of coagulase-positive staphylococci in kebab and salmon tartare and of Bacillus cereus in Älplermagronen, a traditional pasta dish containing macaroni, bacon/ham and sauce (cream, milk, salt, nutmeg, stock powder). In the latter case, the affected individuals developed severe symptoms such as vomiting and diarrhoea roughly one hour after eating the dish. The business that had prepared the dish quarantined it and all the remaining ingredients the same day and they were subsequently tested. Large quantities of Bacillus cereus (>150,000 CFU/g) were detected, congruent with the symptoms experienced by those affected.

In three other reported incidents, food poisoning was caused by ingesting pathogens: Listeria monocytogenes (in salad), Campylobacter jejuni (probably from tap water) and Salmonella enteritidis. In the latter case the collective food poisoning was particularly extensive as it affected the guests at a wedding and more than 30 people fell ill. It was not possible to determine the exact number of people involved. Between 300 and 400 people had been at the reception. The investigating authorities assume that, on the basis of information provided by those affected, the wedding cake containing raw eggs was responsible for the following symptoms: nausea, vomiting, diarrhoea, abdominal spasms, fever, chills and dizziness. All the people who fell ill had eaten the wedding cake. However, it was not possible to confirm a direct relationship between the cake or other foods at the wedding reception and the salmonellosis experienced by the guests since food that could have been used to perform informative analyses was no longer available. Neither did investigations carried out where the cake had been made provide any further information.

Every year, food-related disease outbreaks caused by noroviruses are reported to the authorities. However, it is rarely possible to identify the origin of the viruses and link it to a particular food because no samples are available or too much time elapses between the report and the investigation. An outbreak in 2017 that affected more than 160 people and probably caused illness in between 200 and 300 people is of particular interest. The same symptoms – nausea, vomiting and diarrhoea – developed over two days in five groups of people and several individuals who were all staying at the same ski resort. Noroviruses were detected in some patients. The restaurant meal that was initially thought to have caused the infection in the first group was excluded because the other groups had eaten elsewhere. Since it was not possible to exclude the tap water, which was the only factor common to all the patients, as the potential source of the problem, the authorities imposed measures such as boiling the water before drinking it and reiterated the hygiene rules that must be followed if noroviruses are present. Thanks to these measures in public facilities and
households, the spread of the pathogen was limited to the mountain resort and the incident only lasted a week. Although everything pointed to noroviruses, the actual source was never identified.

Another relevant virus is the hepatitis E virus (HEV), which caused an outbreak involving 24 individuals. This virus occurs in drinking water or contaminated food in countries with low hygiene standards, but it is also found in pigs and wild boar in central Europe and thus in Switzerland too. In this case, people were infected with HEV by eating meat products containing raw or inadequately cooked liver from pigs or wild boar. Measures were taken to prevent an increase in or contain food-related cases. Measures to reduce the risks associated with manufacturing food and the requirement to report cases of hepatitis E that has been in place since 1 January 2018 are intended to improve estimates of the actual number of HEV infections in humans.

It is known that there is a large grey area in the monitoring of food-related infections. For example, not everyone sees a doctor and has their bodily fluids tested. Case reporting is dependent, among other things, on the number of people who fall ill, the severity of the illness, whether the person is admitted to hospital and the interaction between those involved (patients, medical profession, monitoring authorities). Moreover, outbreaks with a short incubation time are often discovered more quickly than those that take longer. For the past several months a particular effort has been made to increase awareness among the various authorities concerned of the importance of reporting cases to the federal authorities. This of course raises the question of whether the slightly higher number of outbreaks of food poisoning in 2017 might not be due this effort to enhance awareness. The figures in the coming years will perhaps provide an answer to this question.

**Table LE—1**: Food-borne disease outbreaks and implicated pathogens in Switzerland in 2017.

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Number of people taken ill</th>
<th>Number of people hospitalised</th>
<th>Contaminated food</th>
<th>Where consumed</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Unknown</td>
<td></td>
<td></td>
<td>Possibly salad</td>
<td>Restaurant</td>
<td>Unknown</td>
</tr>
<tr>
<td>2 Unknown</td>
<td></td>
<td></td>
<td>Possibly whipped cream and ice-cream</td>
<td>Restaurant</td>
<td>Unknown</td>
</tr>
<tr>
<td>3 Unknown</td>
<td></td>
<td></td>
<td>Various barbecued foods (meat and others)</td>
<td>Catering kitchen</td>
<td>Unknown</td>
</tr>
<tr>
<td>4 Unknown</td>
<td></td>
<td></td>
<td>Possibly salad</td>
<td>Catering kitchen</td>
<td>Unknown</td>
</tr>
<tr>
<td>5 Unknown</td>
<td></td>
<td></td>
<td>Pizza</td>
<td>Restaurant</td>
<td>Poor hygiene</td>
</tr>
<tr>
<td>6 Unknown</td>
<td></td>
<td></td>
<td>Cheese</td>
<td>At home</td>
<td>Unknown</td>
</tr>
<tr>
<td>7 Unknown</td>
<td></td>
<td></td>
<td>Falafel</td>
<td>Canteen</td>
<td>Deficiencies in production</td>
</tr>
<tr>
<td>8 Histamine</td>
<td></td>
<td></td>
<td>Tuna</td>
<td>Restaurant</td>
<td>Interrupted cold chain</td>
</tr>
<tr>
<td>9 Histamine</td>
<td></td>
<td></td>
<td>Fish in sauce</td>
<td>Creche</td>
<td>Unknown</td>
</tr>
<tr>
<td>Pathogen</td>
<td>Number of people taken ill</td>
<td>Number of people hospitalised</td>
<td>Contaminated food</td>
<td>Where consumed</td>
<td>Cause</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------------------------------</td>
<td>--------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>10 Coagulase-positive Staphylococci and histamine</td>
<td>10</td>
<td></td>
<td>Carpaccio of raw tuna (histamine) and salmon tartare (staph.)</td>
<td>Restaurant</td>
<td>Deficient self-monitoring (handling fresh and/or raw fish)</td>
</tr>
<tr>
<td>11 Coagulase-positive staphylococci</td>
<td>11</td>
<td></td>
<td>Kebab: processed slices of chicken and lamb</td>
<td>Restaurant</td>
<td>Major deficiencies in hygiene and storage; no self-monitoring concept</td>
</tr>
<tr>
<td>12 <em>Bacillus cereus</em></td>
<td>12</td>
<td></td>
<td>Älplermagronen</td>
<td>Company restaurant not open to public</td>
<td>Poor refrigeration management</td>
</tr>
<tr>
<td>13 <em>Listeria monocytogenes</em></td>
<td>13</td>
<td></td>
<td>Salad</td>
<td>Unknown</td>
<td>Problems during manufacture</td>
</tr>
<tr>
<td>14 <em>Campylobacter jejuni</em></td>
<td>14</td>
<td></td>
<td>Possibly tap water</td>
<td>Group accommodation</td>
<td>Possibly untreated water</td>
</tr>
<tr>
<td>15 <em>Salmonella enteritidis</em></td>
<td>15</td>
<td></td>
<td>Possibly wedding cake</td>
<td>Wedding reception</td>
<td>Unknown</td>
</tr>
<tr>
<td>16 Norovirus</td>
<td>16</td>
<td></td>
<td>Unknown</td>
<td>Restaurant</td>
<td>Unknown</td>
</tr>
<tr>
<td>17 Norovirus</td>
<td>17</td>
<td></td>
<td>Possibly tap water</td>
<td>Several sources</td>
<td>Unknown</td>
</tr>
<tr>
<td>18 Hepatitis E</td>
<td>18</td>
<td></td>
<td>Various foods: liver mortadella, wild boar salami, pig-liver paté</td>
<td>Various</td>
<td>Contaminated raw materials; virus not inactivated during food production</td>
</tr>
</tbody>
</table>
5 Annex

Table ZM—1: Reported evidence of the zoonoses and zoonotic pathogens in humans described in this report. The figures may differ from those published previously since the database of the mandatory reporting system is being corrected continuously. (Source: FOPH, April 2018)

<table>
<thead>
<tr>
<th>Zoonoses and zoonotic pathogens in humans</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>Reporting rate 2017*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter spp. (total)</td>
<td>7480</td>
<td>7571</td>
<td>7070</td>
<td>7980</td>
<td>7219</td>
<td>84.4</td>
</tr>
<tr>
<td>C. jejuni</td>
<td>5300</td>
<td>5646</td>
<td>5315</td>
<td>5340</td>
<td>4319</td>
<td>51.1</td>
</tr>
<tr>
<td>C. coli</td>
<td>402</td>
<td>450</td>
<td>488</td>
<td>475</td>
<td>429</td>
<td>5.1</td>
</tr>
<tr>
<td>C. jejuni or C. coli</td>
<td>1449</td>
<td>1119</td>
<td>888</td>
<td>1423</td>
<td>1182</td>
<td>14.0</td>
</tr>
<tr>
<td>Other Campylobacter spp.</td>
<td>51</td>
<td>97</td>
<td>104</td>
<td>97</td>
<td>73</td>
<td>0.9</td>
</tr>
<tr>
<td>Undetermined Campylobacter spp.</td>
<td>278</td>
<td>259</td>
<td>275</td>
<td>645</td>
<td>1216</td>
<td>14.4</td>
</tr>
<tr>
<td>Salmonella spp. (total)</td>
<td>1265</td>
<td>1241</td>
<td>1375</td>
<td>1517</td>
<td>1848</td>
<td>22.0</td>
</tr>
<tr>
<td>Enteritidis</td>
<td>359</td>
<td>343</td>
<td>478</td>
<td>536</td>
<td>703</td>
<td>8.3</td>
</tr>
<tr>
<td>Typhimurium</td>
<td>198</td>
<td>182</td>
<td>183</td>
<td>179</td>
<td>235</td>
<td>2.8</td>
</tr>
<tr>
<td>4,12:i:i (monphasics)</td>
<td>202</td>
<td>194</td>
<td>133</td>
<td>208</td>
<td>200</td>
<td>2.4</td>
</tr>
<tr>
<td>Infantis</td>
<td>26</td>
<td>43</td>
<td>37</td>
<td>38</td>
<td>27</td>
<td>0.3</td>
</tr>
<tr>
<td>Newport</td>
<td>20</td>
<td>23</td>
<td>31</td>
<td>26</td>
<td>25</td>
<td>0.3</td>
</tr>
<tr>
<td>Stanley</td>
<td>39</td>
<td>11</td>
<td>23</td>
<td>31</td>
<td>29</td>
<td>0.3</td>
</tr>
<tr>
<td>Napoli</td>
<td>17</td>
<td>18</td>
<td>22</td>
<td>24</td>
<td>35</td>
<td>0.4</td>
</tr>
<tr>
<td>Virchow</td>
<td>22</td>
<td>8</td>
<td>20</td>
<td>20</td>
<td>10</td>
<td>0.1</td>
</tr>
<tr>
<td>Thompson</td>
<td>5</td>
<td>5</td>
<td>18</td>
<td>5</td>
<td>4</td>
<td>0.0</td>
</tr>
<tr>
<td>Kentucky</td>
<td>17</td>
<td>14</td>
<td>17</td>
<td>17</td>
<td>23</td>
<td>0.3</td>
</tr>
<tr>
<td>Other serotypes</td>
<td>330</td>
<td>364</td>
<td>338</td>
<td>360</td>
<td>363</td>
<td>4.3</td>
</tr>
<tr>
<td>Undetermined serotypes</td>
<td>30</td>
<td>36</td>
<td>75</td>
<td>73</td>
<td>194</td>
<td>2.3</td>
</tr>
<tr>
<td>Shiga toxin-producing E. coli (STEC)*</td>
<td>82</td>
<td>125</td>
<td>315</td>
<td>463</td>
<td>696</td>
<td>8.2</td>
</tr>
<tr>
<td>of which HUS*</td>
<td>11</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>19</td>
<td>0.2</td>
</tr>
<tr>
<td>Listeria monocytogenes (total)</td>
<td>64</td>
<td>98</td>
<td>54</td>
<td>51</td>
<td>45</td>
<td>0.5</td>
</tr>
<tr>
<td>Serotype 1/2a</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>18</td>
<td>15</td>
<td>0.2</td>
</tr>
<tr>
<td>Serotype 1/2b</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>0.1</td>
</tr>
<tr>
<td>Serotype 1/2c</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Serotype 4b</td>
<td>24</td>
<td>59</td>
<td>20</td>
<td>22</td>
<td>18</td>
<td>0.2</td>
</tr>
<tr>
<td>Other serotypes</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Undetermined serotypes</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>0.1</td>
</tr>
<tr>
<td>Brucella spp.</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>7</td>
<td>9</td>
<td>0.1</td>
</tr>
<tr>
<td>Francisella tularensis*</td>
<td>29</td>
<td>39</td>
<td>50</td>
<td>55</td>
<td>131</td>
<td>1.5</td>
</tr>
<tr>
<td>Mycobacterium bovis</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Trichinella spp.</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Coxiella burnetii*</td>
<td>26</td>
<td>43</td>
<td>40</td>
<td>47</td>
<td>42</td>
<td>0.5</td>
</tr>
<tr>
<td>West Nile fever*</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1) Number of definite (confirmed clinically and by laboratory testing) and probable (laboratory-confirmed) cases
2) Haemolytic uraemic syndrome; 3) Number of definite (confirmed clinically and by laboratory testing) cases;
4) Notifiable since 1 November 2012; 5) Imported
Table ZT—1: Overview of the zoonoses described in this report and the associated case numbers reported in animals, 2013–2017. (Source: FSVO, April 2018)

<table>
<thead>
<tr>
<th>Zoonoses in animals</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacteriosis</td>
<td>82</td>
<td>164</td>
<td>158</td>
<td>142</td>
<td>122</td>
</tr>
<tr>
<td>Salmonellosis</td>
<td>76</td>
<td>63</td>
<td>79</td>
<td>127</td>
<td>105</td>
</tr>
<tr>
<td><em>Salmonella</em> infection in poultry</td>
<td>3</td>
<td>11</td>
<td>5</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Listeriosis</td>
<td>8</td>
<td>9</td>
<td>6</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>Brucellosis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tularaemia</td>
<td>4</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>10</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Trichinellosis</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Echinococcosis</td>
<td>11</td>
<td>9</td>
<td>9</td>
<td>38</td>
<td>92</td>
</tr>
<tr>
<td>Q fever (<em>Coxiella burnetii</em>)</td>
<td>68</td>
<td>58</td>
<td>83</td>
<td>94</td>
<td>113</td>
</tr>
<tr>
<td>West Nile fever</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table RE—1: National reference laboratories and reference centres with their reference function for the zoonoses and zoonotic pathogens described in the report.

<table>
<thead>
<tr>
<th>Reference laboratory / reference centre</th>
<th>Reference function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institute of Veterinary Bacteriology, National Centre for Zoonoses, Bacterial Animal Diseases and Antibiotic Resistance (ZOBA), Vetsuisse Faculty at the University of Bern</td>
<td>Brucellosis</td>
</tr>
<tr>
<td></td>
<td>Salmonellosis</td>
</tr>
<tr>
<td></td>
<td>Campylobacteriosis</td>
</tr>
<tr>
<td></td>
<td>Listeriosis</td>
</tr>
<tr>
<td></td>
<td>Yersiniosis</td>
</tr>
<tr>
<td></td>
<td>Tularaemia</td>
</tr>
<tr>
<td>Institute of Food Safety and Hygiene (ILS), Vetsuisse Faculty at the University of Zurich</td>
<td>Infection with shiga toxin-forming <em>E. coli</em> (STEC)</td>
</tr>
<tr>
<td>Institute of Veterinary Bacteriology, Vetsuisse Faculty, University of Zurich</td>
<td>Tuberculosis</td>
</tr>
<tr>
<td>Institute of Parasitology, Vetsuisse Faculty, University of Bern</td>
<td>Trichinellosis</td>
</tr>
<tr>
<td>Institute of Parasitology, Vetsuisse Faculty, University of Zurich</td>
<td>Toxoplasmosis</td>
</tr>
<tr>
<td>Institute of Virology and Immunology (IVI)</td>
<td>Echinococcosis</td>
</tr>
<tr>
<td>Institute of Virology and Immunology (IVI)</td>
<td>West Nile fever</td>
</tr>
<tr>
<td>Swiss Rabies Centre</td>
<td>Rabies</td>
</tr>
<tr>
<td>Humans</td>
<td></td>
</tr>
<tr>
<td>National Centre for Enteropathogenic Bacteria and Listeria (NENT), University of Zurich</td>
<td>Salmonellosis</td>
</tr>
<tr>
<td></td>
<td>Campylobacteriosis</td>
</tr>
<tr>
<td></td>
<td>Yersiniosis</td>
</tr>
<tr>
<td></td>
<td>Listeriosis</td>
</tr>
<tr>
<td><strong>Reference laboratory / reference centre</strong></td>
<td><strong>Reference function</strong></td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>National Centre for Emerging Viral Diseases (NAVI), University of Geneva</td>
<td>West Nile fever</td>
</tr>
<tr>
<td>National Centre for Mycobacteria (NCM), University of Zurich</td>
<td>Tuberculosis</td>
</tr>
<tr>
<td>Institute of Virology and Immunology (IVI), Swiss Rabies Centre</td>
<td>Rabies</td>
</tr>
<tr>
<td>Spiez Laboratory, National Reference Centre for Tick-transmitted Diseases</td>
<td>Q fever (coxiellosis)</td>
</tr>
<tr>
<td>(NRZK)</td>
<td></td>
</tr>
<tr>
<td>Spiez Laboratory, National Anthrax Centre (NANT)</td>
<td>Anthrax</td>
</tr>
<tr>
<td></td>
<td>Tularaemia</td>
</tr>
<tr>
<td></td>
<td>Yersiniosis</td>
</tr>
<tr>
<td></td>
<td>Brucellosis</td>
</tr>
<tr>
<td><strong>Food</strong></td>
<td></td>
</tr>
<tr>
<td>Institute of Food Safety and Hygiene (ILS), Vetsuisse Faculty at the</td>
<td>Salmonellosis</td>
</tr>
<tr>
<td>University of Zurich</td>
<td>Campylobacteriosis</td>
</tr>
<tr>
<td>Agroscope</td>
<td>Listeriosis</td>
</tr>
<tr>
<td></td>
<td>Infection with <em>E. coli</em> (including VTEC)</td>
</tr>
</tbody>
</table>