Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of Home Affairs

Federal Food Safety and Veterinary Office FSVO
Animal Health
Surveillance of Animal Health

October 2015

Report on the surveillance of animal diseases and zoonoses

2014 data

Federal Food Safety and Veterinary Office FSVO

Schwarzenburgstrasse 155
3003 Bern
Switzerland

Website: www.blv.admin.ch
E-mail: info@blv.admin.ch
Telephone: +41-(0)58-463 30 33

Contents

2 Summary

The health of animals is an important requirement for their well-being, however it is also of benefit to humans: foods that are of animal origin can be produced in a safer and more effective way. They also enhance the competitiveness of Switzerland's agricultural sector and make a positive contribution towards the maintenance of public health. For these reasons, animal health is monitored on a continual basis and in comparison to other countries, Switzerland has already achieved a high standard in that regard.

The surveillance of animal health is carried out in a number of different ways. These include the screening programmes organised and financed by the Federation and by the cantons. These are undertaken in collaboration with practising veterinarians and meat inspections carried out at the point of slaughter, as well as with accredited laboratories. In addition, general surveillance of animal health is also carried out on the basis of a duty to report by animal keepers and all individuals who come into contact with animals. The examinations carried out upon imported animals and aborted foetuses in ungulates (hooved animals) form important pillars of this surveillance. This report sets out to provide an overview of animal health surveillance as it exists in 2014, explaining the significance of animal health surveillance and placing it in the context of previous years.

For a number of years now, a process of structural change has been underway within Switzerland's agricultural sector, involving a shift towards fewer farms with larger numbers of stock. In 2014, the population of many types of livestock changed in line with that trend. According to the statistics produced by the Meat Inspectorate, the total number of slaughtered animals, together with the proportion of inedible animal carcases, remained largely unchanged. The diagnosis of animal diseases in Switzerland is carried out by 25 accredited laboratories, which are either operated by the State or are privately run. In 2014, they carried out almost 20% fewer tests for animal diseases than in the preceding year (the reason: fewer examinations were carried out in connection with the programme to combat bovine viral diarrhoea). The largest number of investigations in the context of national disease-prevention and random sampling carried out by state authorities was carried out upon cattle. As a result of this, Switzerland was successfully certified as free of 6 animal diseases in 2014, namely infectious bovine rhinotracheitis, enzootic bovine leukosis, bluetongue disease in cattle, brucellosis in sheep and goats, Aujeszky's disease and porcine reproductive and respiratory syndrome in pigs. This certification must be renewed each year by carrying out random sampling. The reason for this is that previously eradicated animal diseases could be brought back into the country again at any time.

A great many animal diseases are also zoonoses and are therefore potentially harmful to human health. The most frequently recorded of these is campylobacteriosis. In 2014, the number of cases of this diarrhoeal illness continued to be high (7,565 cases). Prior to this, numbers had peaked during the period between 2005 and 2012 (from around 5,000 to around 8,500 cases). As a large number of sufferers do not visit their doctor and stool samples are not always investigated, the actual figure may be a lot higher. As a result of this development, researchers, the poultry sector (poultry forms the primary source of infection in humans) and representatives of government authorities got together in late 2008 to form the *Campylobacter* Platform. The aim of the platform is to make a contribution towards the containment of this diarrhoeal pathogen, by means of the transfer of knowledge, by carrying out coordinated measures and by initialising research projects. Another frequently occurring type of zoonosis involves infection by *Salmonella* bacteria. In humans, this can give rise to gastro-intestinal complaints, amongst other things. In many cases, animals merely act as a carrier and do not suffer any symptoms themselves. In 2014, the number of cases of salmonellosis in humans was at the same level as in the previous year (1,238 cases). Active measures are underway to combat *Salmonella* infection in poultry. At no point during the past few years was the number of *Salmonella* infections recorded in poultry ever greater than 11.

In Switzerland, cases in which entire groups of people are infected with a pathogen as a result of eating certain foods are extremely rare indeed. Only 11 such outbreaks were recorded in 2014. These involved infections with Listeria, Salmonella, *Campylobacter* and toxin-producing pathogens such as *Staphylococcus aureus* and *Bacillus cereus*. A programme is also underway to monitor the development of antibiotic resistance in zoonotic pathogens and indicator bacteria in commercial livestock. During the year

under review, this was adapted in line with the latest EU requirements. Among the zoonotic pathogens, the rate of resistance of *C. jejuni* to ciprofloxacin increased further, as did the occurrence of Methicillin-resistant *Staphylococcus aureus* in slaughtered pigs.

3 Principles of monitoring epizootics and zoonoses

The aim of animal health monitoring is to establish the current situation with regard to epidemics, development trends and the regional distribution of outbreaks. In the case of epizootics that have been eradicated, freedom from disease is documented with the aid of inspection programmes. The general public, the EU and the World Organisation for Animal Health (OIE) are kept informed regularly.

State monitoring of animal health focuses on the monitoring of epizootics. Transmissible diseases are referred to as epizootics if they can be transmitted to humans (zoonoses); if they cannot be averted by an individual animal keeper with any prospect of success without the involvement of other animal populations; if they could threaten indigenous wild animal species; if they could have significant economic consequences or if they are of significance to international trade in animals and animal products (Swiss Animal Health Act of 1 July 1966 (TSG, SR 916.40), Art. 1). Accordingly, around 80 diseases are classed as epizootics (Swiss Animal Health Ordinance of 27 June 1995 (TSV, SR 916.401) Art. 2–5). Zoonoses are thus treated in the same way as epizootics in principle, even if there are additional regulations that apply to zoonoses, as listed below. All epizootics must be reported to the authorities. Highly infectious epizootics are eradicated as quickly as possible, while many other epizootics are combated with the aim of eradicating them or at least reducing their effects on health or economic consequences.

Monitoring of animal health involves a variety of measures (**Figure 3.a**). The term 'National Monitoring Programme' brackets together individual disease-specific inspection programmes, which are planned and implemented on a coordinated basis. For each inspection programme, the aim of the inspections is stipulated and, based on this, the procedure for sampling and laboratory diagnostics. Other monitoring measures include the obligation to report epidemics to the authorities, which applies to all epizootics, the obligation to investigate and examine abortions in ungulates, as well as inspections ordered by the official veterinarian in connection with the importing of animals and the inspection of carcasses and organs by the meat inspectorate when animals are slaughtered.

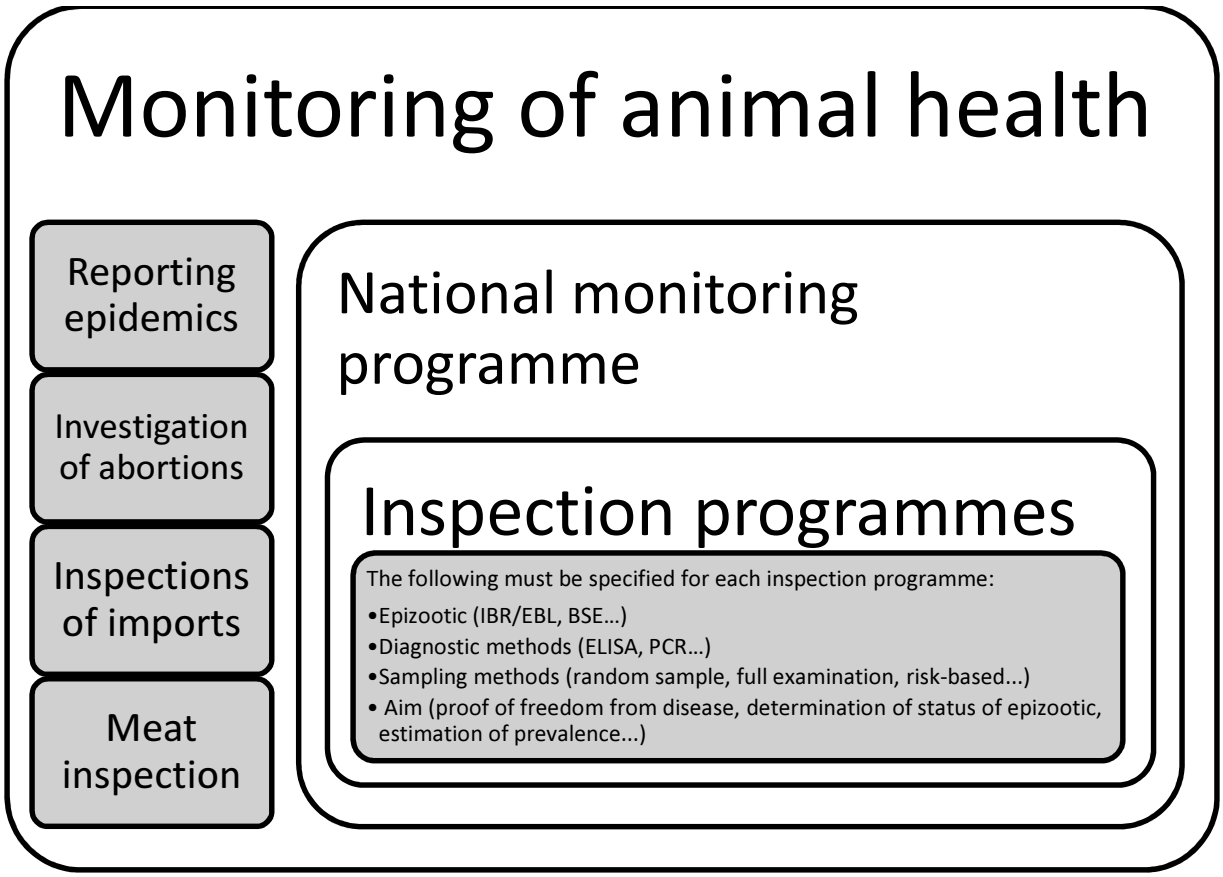


Figure 3.a: The monitoring of animal health includes the national monitoring programme as well as the reporting of epidemics, the investigation of abortions and inspection of imports and monitoring by the meat inspectorate

3.1 Epizootics

As part of the monitoring programme, Switzerland's freedom from disease is documented with an inspection programme in the case of epizootics that have been eradicated and that are of major significance to international trade. Samples from companies are inspected every year and, on the basis of negative test results, the national animal population is declared to be free from disease. Samples are taken in a way that ensures compliance with all international standards and enables scientifically sound conclusions that are backed up by statistics to be drawn regarding the overall population. The samples from cattle companies also take into account so-called sentinel companies. These are companies that, due to specific factors such as the transportation of larger numbers of animals, direct imports of animals or a location near the border, can provide more information about the possible import of epidemics than companies that are chosen at random. The inclusion of sentinel companies allows the total number of companies inspected to be significantly reduced. Proof of freedom from disease was provided in 2014 for infectious bovine rhinotracheitis (IBR), enzootic bovine leukosis (EBL), blue tongue disease in cattle, brucellosis in sheep and goats, Aujeszky's disease and porcine reproductive and respiratory syndrome (PRRS) in pigs.

For other epizootics, an inspection programme is being carried out with the aim of documenting the extent of possible occurrence. In the inspection programme for bovine spongiform encephalopathy (BSE), all animals aged four years and over are assigned to the risk groups "cows slaughtered while ill" and "fallen cows". The progressive eradication of bovine viral diarrhoea (BVD) is being investigated in a comprehensive serological inspection programme with bulk tank milk samples and blood samples.

In poultry, a sample from flocks is tested for avian influenza viruses and the Newcastle disease virus. The aim is to detect subclinical infections with low pathogenic viruses of the H5 and H7 subtypes at an early stage, as these could mutate into highly pathogenic avian influenza agents.
With regard to the duty to report epizootics to the authorities, all persons who keep, care for or treat animals and the laboratories that investigate epizootics have an obligation to report epidemics and suspicious diseases. These must be reported to the cantonal veterinary offices, which in turn report to the Federal Food Safety and Veterinary Office (FSVO). The FSVO publishes the current situation with regard to epidemics, development trends and the regional distribution of outbreaks online (www.infosm.blv.admin.ch/public/). The animal health statistics that are drawn up annually show the following: Switzerland is free from all highly infectious epizootics and many other epizootics (www.blv.admin.ch/). The World Organisation for Animal Health (OIE) and the European Commission are notified regularly of the situation with regard to epidemics. The occurrence of highly infectious or exotic epidemics – and other specific incidents – would be reported to these partners immediately. A good reporting system requires constant observation of animals by the people who keep them, reliable recognition of the signs of illness, examination of sick animals by veterinarians and testing in competent laboratories. Reliable monitoring and appropriate reporting ensures transparent and comprehensible communications regarding the health situation.
Other important areas of the monitoring of epizootics include the investigation of abortions in ungulates and meat inspections at the slaughterhouse. Some epizootics are known to cause abortions, which means that abortions can be a sign of epizootics. The obligation to report abortions to the authorities and the investigation of abortions are thus an important part of the monitoring of epizootics. The occurrence of abortions in cattle, small ruminants and pigs must be reported to the authorities. Depending on the animal species, the official veterinarian will order tests for Brucella, IBR viruses, *Coxiella burnetii*, chlamydia, PRRS viruses and possibly other pathogens. Suitable sanitation measures are then implemented at the companies, based on the laboratory results.
Meanwhile, the meat inspectorate examines every slaughtered animal while it is still alive, as well as its carcass and organs. Any suspicious animals or carcasses are confiscated and further investigations are ordered. This allows epizootics to be identified from the symptoms and the safety of meat as a foodstuff to be ensured. Monitoring by the meat inspectorate is particularly important in the case of tuberculosis, which can be identified from changes in lymph nodes.

3.2 Zoonoses

The Swiss Animal Health Ordinance contains specific regulations on zoonoses (TSV, Art. 291a–291e). The zoonoses brucellosis, campylobacteriosis, echinococcosis, listeriosis, salmonellosis, trichinellosis, tuberculosis – caused by *Mycobacterium bovis* – and verotoxin-producing *Escherichia coli* are individually mentioned. Brucellosis and tuberculosis are investigated as part of the monitoring of epizootics. With regard to trichinellosis, all pigs and horses are tested for Trichinella when they are slaughtered. The combating of Salmonella in the animal population focuses on the programme to control Salmonella infections in poultry and the combating of salmonellosis in various animal species. Monitoring in poultry is geared towards the detection and extermination of infected flocks. The aim is to lower the burden of pathogens in eggs and meat and thus to reduce human exposure. Monitoring for Campylobacter takes place all year round when animals are slaughtered, as part of the programme to investigate resistance to antibiotics. The information obtained from this is used, together with the number of cases of campylobacteriosis in humans, to assess the situation on an ongoing basis. The Campylobacter platform coordinates and implements measures to reduce the burden of Campylobacter throughout the food chain on this basis, with all those concerned.
Zoonoses are naturally also highly significant to the health of humans, and many must be reported to the authorities by doctors and laboratories. Reports are reviewed on an ongoing basis and published online at www.bag.admin.ch/infreporting/index.htm. Cantonal enforcement bodies must report outbreaks of food-related illnesses to the FSVO as soon as investigations are completed.

A special inspection programme aims to monitor resistance to antibiotics in livestock, with the primary intention of detecting the spread of resistant germs that could be transmitted to humans in food. The programme includes agents that cause zoonoses and indicator germs in cattle, pigs and chickens. In accordance with a risk-based plan, swabs are taken at the time of slaughtering and samples of meat are taken at sales outlets. The germs are investigated with regard to their resistance to a wide range of antibiotics and with regard to multiple resistance. A planned course of action means that comparable figures are available regarding resistance and that unfavourable developments can be identified.
Switzerland produces an annual report for the EU on the occurrence and prevalence of zoonoses, the causes of zoonoses and resistance to antibiotics (TSV, Art. 291e). This is sent to the European Food Safety Authority (EFSA), which compiles a summary for Europe based on this report and the reports from the member states and Norway. http://www.efsa.europa.eu/en/efsajournal/pub/3991.htm. The harmonisation of monitoring activities and active communication of results leads to credible and comparable information for the individual states, which can be used to assess the situation with regard to zoonoses and resistance.

4 Animal population

Fewer companies, larger animal populations – that is the structural change that has been emerging in the agricultural sector over the last few years. The population of many types of livestock changed in the year under review in line with these expectations. Meanwhile, the number of imports reflects the fact that the tip of the breeding pyramid for poultry is abroad.

4.1 Companies with livestock, animal population and imported livestock

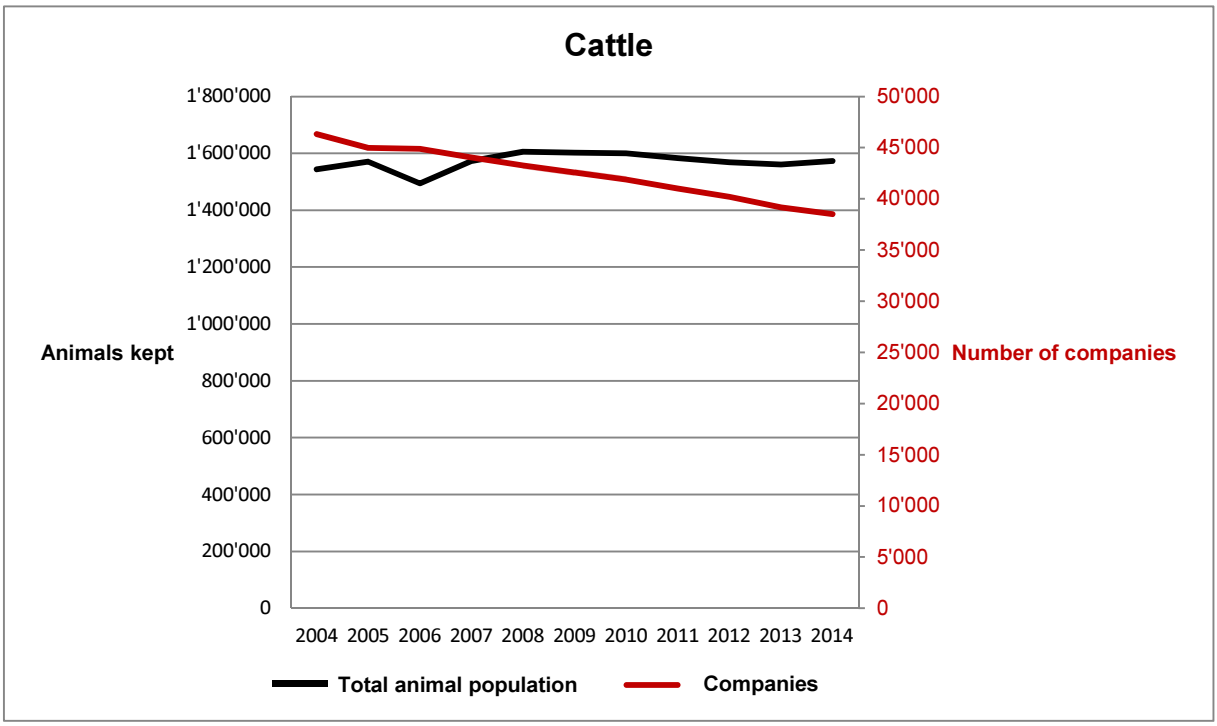
A structural change has been observed in agriculture over the last few years: it is assumed that in future there will probably be fewer and fewer companies, but that they will have larger animal populations. No change in this trend was observed in 2014. The data in **Table 4.a** illustrate this. For cattle, pigs, sheep and goats, the number of companies declined further (**Figures 4.a and 4.b,** red curve in each case). At the same time, overall numbers of cattle and pigs increased (**Figures 4.a and 4.b,** black curve in each case). The fact that the latter were barely imported at all in 2014 may be linked to the fact that pig breeding has become established in Switzerland. With horses, in contrast, there was lively trade with other countries. Meanwhile, the figures for poultry reflect the fact that the tip of the breeding pyramid is abroad. Imports of day-old chicks and hatching eggs therefore significantly outweighed those of other categories of animals once again in 2014.

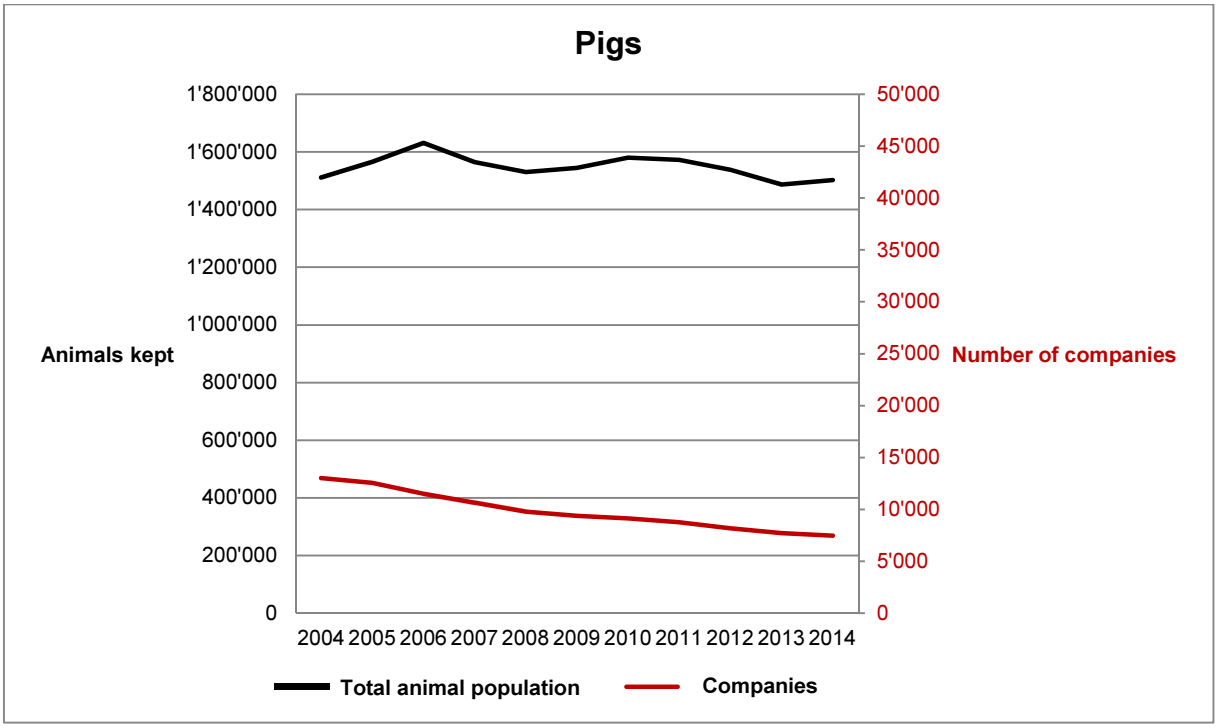
Category of animals		2013	2014	Change [%] 2013–2014
Cattle	Companies	39,161	38,504	-1.7
	Total population	1,560,293	1,573,540	0.8
	Imported animals	1,636	1,365	-16.6
Pigs	Companies	7,692	7,455	-3.1
	Total population	1,487,136	1,502,461	1.0
	Imported animals	109	86	-21.1
Sheep	Companies	8,784	8,599	-2.1
	Total population	403,934	399,591	-1.1
	Imported animals	539	417	-22.6
Goats	Companies	5,816	5,728	-1.5
	Total population	83,475	83,319	-0.2
	Imported animals	142	64	-54.9
Horse family	Companies	8,514	8,375	-1.6
	Total population	55,732	51,282	-8.0
	Imported animals	3,405	3,388	-0.5
Breeding hens and cocks (laying and broiler lines)	Companies	1,298	1,520	17.1
	Total population	167,568	154,059	-8.1
	Imported day-old chicks	320,706	346,869	8.2
Laying hens of any age	Companies	16,814	17,262	2.7
	Total population	3,547,181	3,785,782	6.7
	Imported day-old chicks	14,280	20,020	40.2
Broiler chickens of any age	Companies	1,057	1,083	2.5
	Total population	6,377,308	6,799,127	6.6
	Imported day-old chicks	14,230	10,149	-28.7
	Imported hatching eggs	32,266,439	36,123,533	12.0
Turkeys of any age incl. pre-fattening and grow-out periods	Companies	292	315	7.9
	Total population	58,646	50,432	-14.0
	Imported hatching eggs	289,226	204,400	-29.3
Bees	Beekeepers	–	14,525	–
	Colonies	–	148,328	–
	Imported colonies	–	2,398	–

Table 4.a: Companies with livestock, animal population and imported livestock in the year under review, compared with 2013

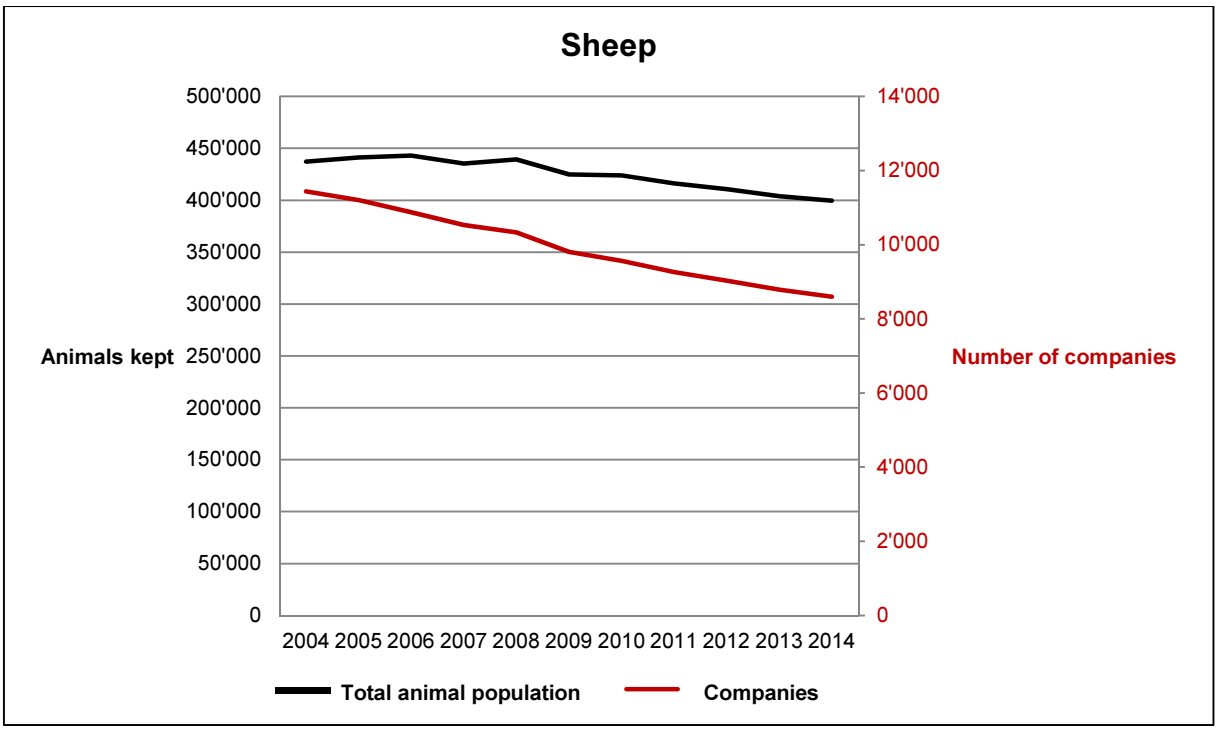
Sources: Agricultural policy information system AGIS, FOAG; imports, TRACES; imports of poultry, FOAG

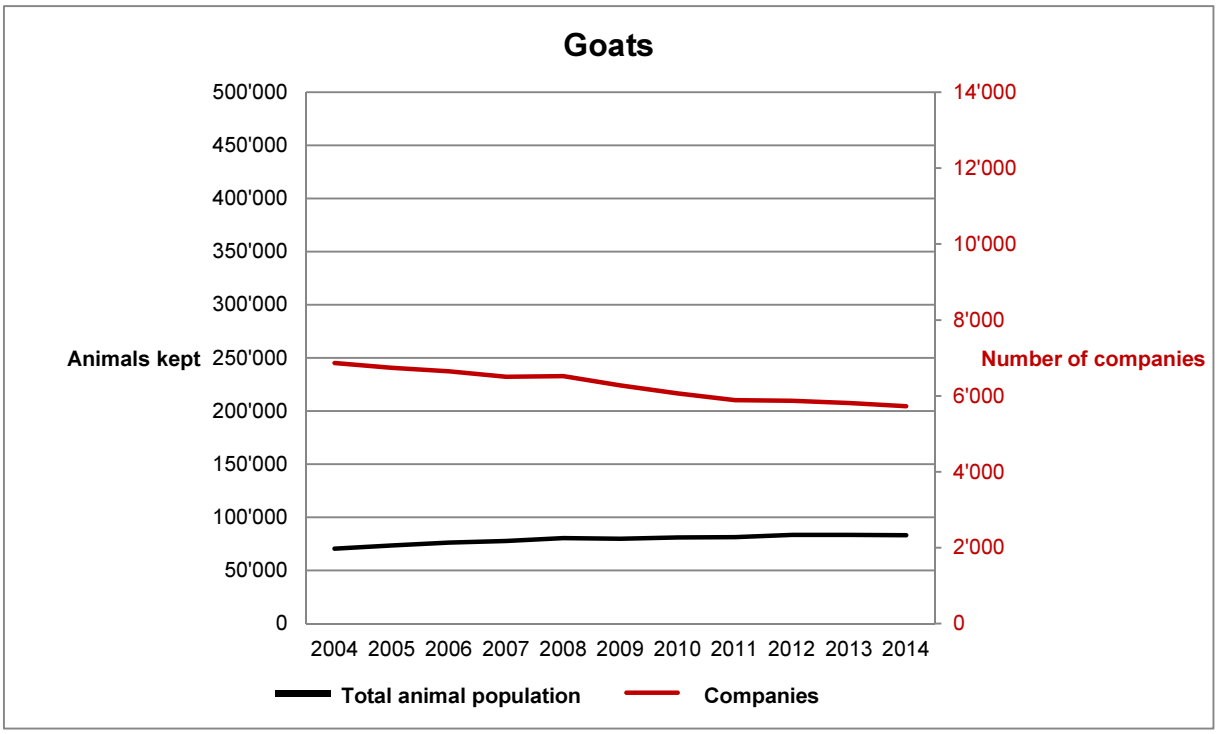
4.2 Changes in the keeping of livestock 2004–2014





Figures 4.a: Number of companies with cattle or pigs (red curve, y-axis on the right) and animals kept per company (black curve, y-axis on the left) from 2004 to 2014





Figures 4.b: Number of companies with sheep or goats (red curve, y-axis on the right) and animals kept per company (black curve, y-axis on the left) from 2004 to 2014

5 Slaughter and meat inspection statistics

It is stipulated by law that every slaughtered animal must be inspected to make sure that it is fit for human consumption, as part of checks on animals to be slaughtered and on meat. The results of these inspections are forwarded to the meat inspectorate's database (Fleko). This results in reliable statistics on the number of animals slaughtered per year. The figures for 2014 show that the overall number of animals slaughtered and the percentage of animals that were unfit for consumption were within the same range as in the previous year.

5.1 Legal basis

The Swiss ordinance on slaughter and meat inspection (VSFK, SR 817.190) stipulates that the results of inspections of animals for slaughter and of meat must be forwarded to the database on the transportation of animals (TVD ordinance of 26 October 2011) in electronic form, stating the registration numbers of the companies (TVD numbers).
The meat inspection statistics are an official set of statistics compiled for Switzerland in accordance with the ordinance on the collection of statistics (SR 431.012.1) and a multi-annual statistical programme by the Swiss Federal Statistical Office (FSO). Statistics on the number of slaughtered animals allow the classification of animal species in terms of their economic importance and of possible risks to humans that may arise from meat as a foodstuff.

5.2 Meat inspection statistics

The database of the meat inspectorate (Fleko, Identitas) contains the number of slaughtered animals recorded by the meat inspectorate and the decisions of the meat inspectors on fitness for consumption. This forms the basis for the meat inspection statistics. **Table 5.a** shows the number of slaughtered animals per canton and the changes compared with the previous year. **Table 5.b** shows the meat inspectorate's assessment for 2014 for each animal species. The reasons why meat was unfit for consumption in 2014 are listed in **Table 5.c** and shown in **Figure 5.a**.
Figures 5.b and 5.c show changes in the numbers of slaughtered animals and in the number of animal carcasses that were not fit for consumption since 2005.

The Fleko database does not record figures for poultry. The data for the slaughtering of poultry have been obtained from the agricultural policy information system AGIS of the Federal Office of Agriculture (FOAG). The volume of poultry slaughtered is stated in tonnes rather than in units. The proportion of meat that is unfit for consumption is not recorded. **Table 5.d** shows the volume of poultry slaughtered in 2013 and 2014 and compares the figures for the two years.

Canton	Cattle < 6 we.	Cattle > 6 we.	Sheep	Goats	Pigs	Horses	Total
Aargau	87	8,928	8,935	811	30,152	266	49,179
Appenzell i/Rh.	3	579	424	396	1,742	1	3,145
Appenzell a/Rh.	10	594	549	284	1,803	60	3,300
Bern	312	59,583	33,792	9,515	148,374	725	252,301
Basel-Landschaft	29	1,954	16,336	132	3,003	124	21,578
Basel-Stadt	–	4,486	23,317	15	565,395	–	593,213
Fribourg	133	95,655	2,476	521	397,050	122	495,957
Geneva	–	453	1,958	312	1,040	–	3,763
Glarus	63	815	705	437	2,838	1	4,859
Graubünden	97	6,142	4,863	4,198	4,024	39	19,363
Jura	299	4,097	1,595	283	8,046	588	14,908
Lucerne	975	30,607	15,861	3,415	305,548	157	356,563
Neuchâtel	–	1,076	423	51	6,608	5	8,163
Nidwalden	2	1,648	675	299	5,848	27	8,499
Obwalden	475	876	410	159	3,580	2	5,502
St. Gallen	483	115,179	11,612	3,589	744,771	132	875,766
Schaffhausen	–	483	300	49	1,543	18	2,393
Solothurn	6	150,370	393	88	1,755	–	152,612
Schwyz	135	21,666	4,981	1,376	67,112	6	95,276
Thurgau	–	5,275	4,160	380	23,443	192	33,450
Ticino	–	1,263	1,311	3,420	2,198	29	8,221
Uri	1	560	559	463	1,067	1	2,651
Vaud	457	34,331	30,041	1,365	114,826	314	181,334
Valais	23	4,168	5,126	897	3,124	31	13,369
Zug	–	1,324	1,487	122	1,253	3	4,189
Zurich	1,323	92,247	46,358	1,202	296,298	54	437,482
Principality of Liechtenstein	–	85	249	174	280	–	788
Total for 2014	**4,913**	**644,444**	**218,896**	**33,953**	**2,742,721**	**2,897**	**3,647,824**
Total for 2013	3,783	643,322	218,362	31,242	2,680,276	3,195	3,580,180
Difference	1,130	1,122	534	2,711	62,445	-298	67,644
Change [%] compared with 2013	29.87	0.17	0.24	8.68	2.33	-9.33	1.89

Table 5.a: Number of animals slaughtered by species per canton in 2014
Source: Database of the meat inspectorate (Fleko), Identitas

Species	Switzerland		Abroad		Illness/accident		Total		Animals
	fit for consump-tion	not fit for consump-tion	fit for consump-tion	not fit for consump-tion	fit for consump-tion	not fit for consump-tion	fit for consump-tion	not fit for consump-tion	Total
Cattle < 6 we.	4,741	30	0	0	120	22	4,861	52	4,913
Cattle > 6 we.	630,443	914	2,819	0	8,457	1,811	641,719	2,725	644,444
Sheep	218,247	209	0	0	391	49	218,638	258	218,896
Goats	33,781	38	0	0	118	16	33,899	54	33,953
Pigs	2,729,284	3,916	1,000	0	7,832	689	2,738,116	4,605	2,742,721
Horses	2,773	26	0	0	66	32	2,839	58	2,897
Total for 2014	**3,619,269**	**5,133**	**3,819**	**0**	**16,984**	**2,619**	**3,640,072**	**7,752**	**3,647,824**
Total for 2013	3,552,655	5,331	3,855	0	15,622	2,717	3,572,132	8,048	3,580,180
Difference	66,614	-198	-36	0	1,362	-98	67,940	-296	67,644
Change [%] compared with 2013	1.88	-3.71	-0.93	0.00	8.72	-3.61	1.90	-3.68	1.89

Table 5.b: Results from the meat inspectorate for 2014
Source: Database of the meat inspectorate (Fleko), Identitas

Reasons for unfitness for consumption	Number	Proportion [%]
Abscesses in various parts of the body	1592	24.44
Meat that significantly deviates from standards (appearance, consistency, colour, smell or taste)	1472	22.60
Severe acute changes (all kinds of inflammation)	1083	16.63
Symptoms of pyaemia, toxaemia, bacteraemia, viraemia	770	11.82
Severe emaciation	371	5.70
Severe injuries to various parts of the body	243	3.73
Foreign material that is prohibited or above the limit	226	3.47
Fallen or dying	218	3.35
Epizootic (generalised sarcosporidiosis, generalised cysticercosis, tuberculosis, listeriosis, salmonellosis, blackleg)	138	2.12
Generalised erysipelas in pigs	120	1.84
Clinical symptoms	98	1.50
Contaminated or scalded carcasses	97	1.49
Incorrect slaughtering, meat inspection or inspection of animal to be slaughtered	76	1.17
Other	10	0.15

Table 5.c: Reasons reported for unfitness for consumption in 2014
Source: Database of the meat inspectorate (Fleko), Identitas

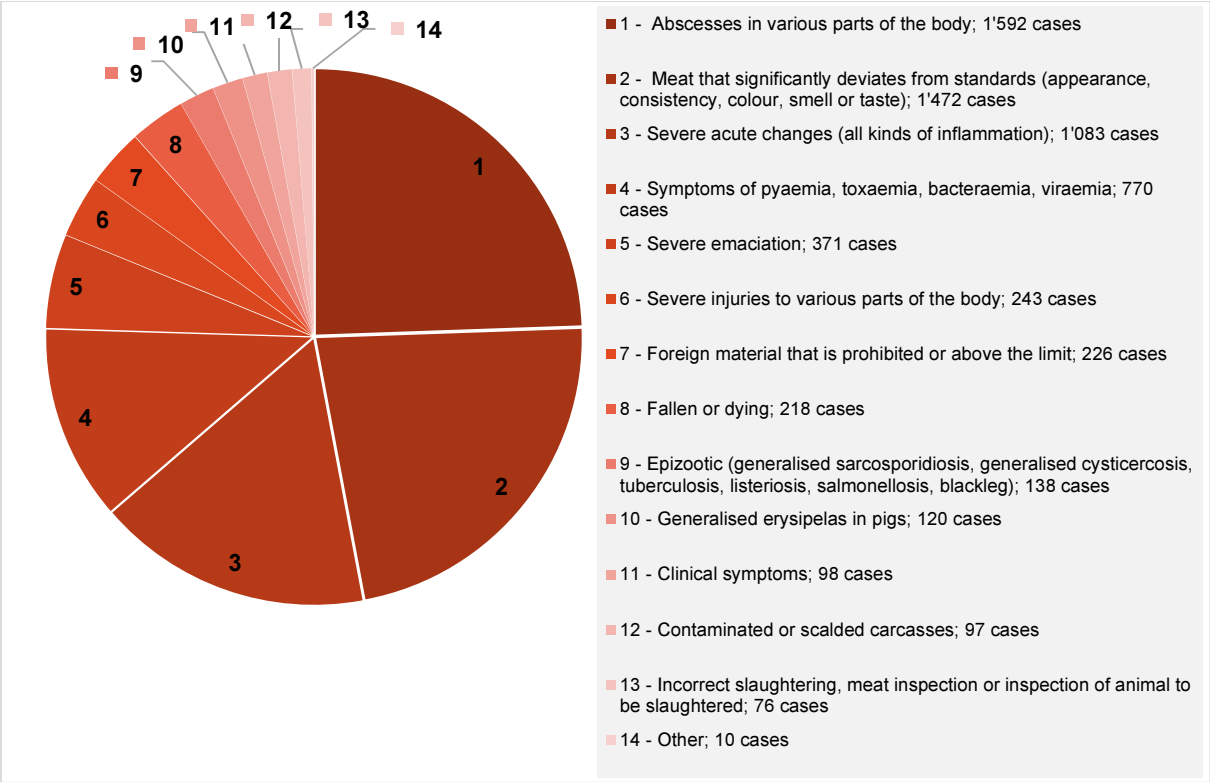
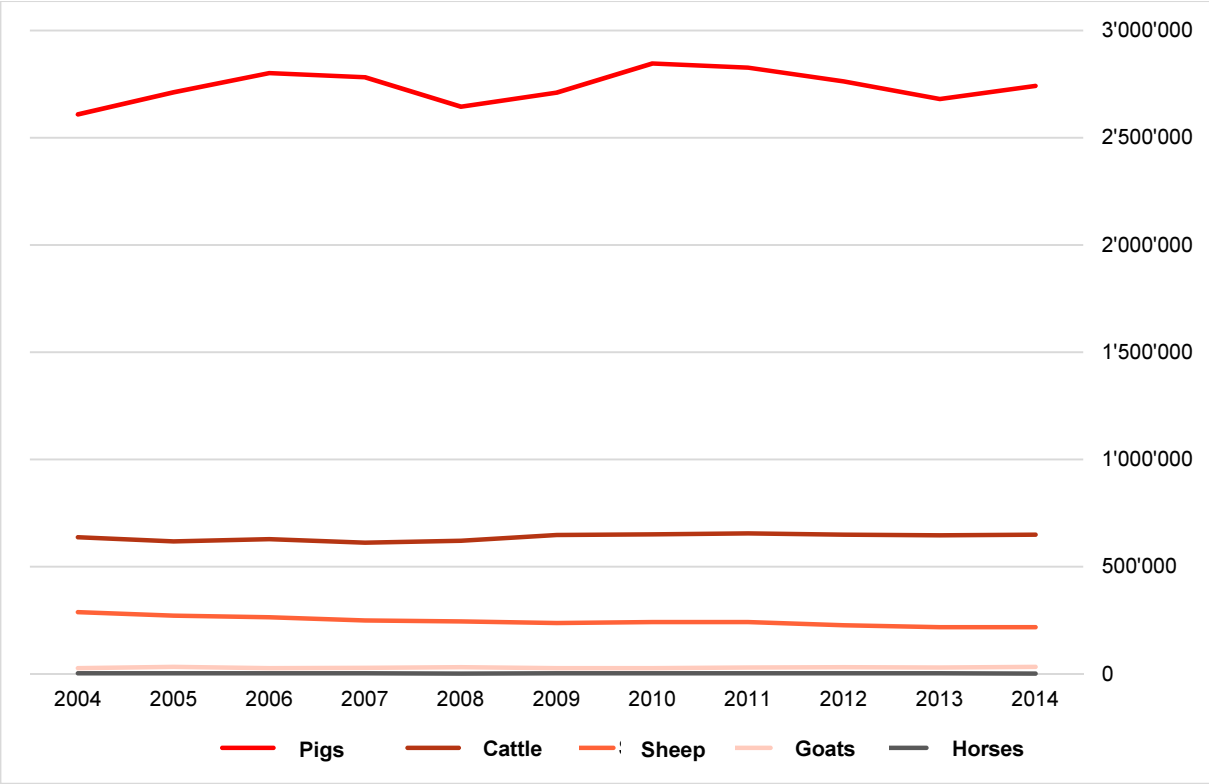
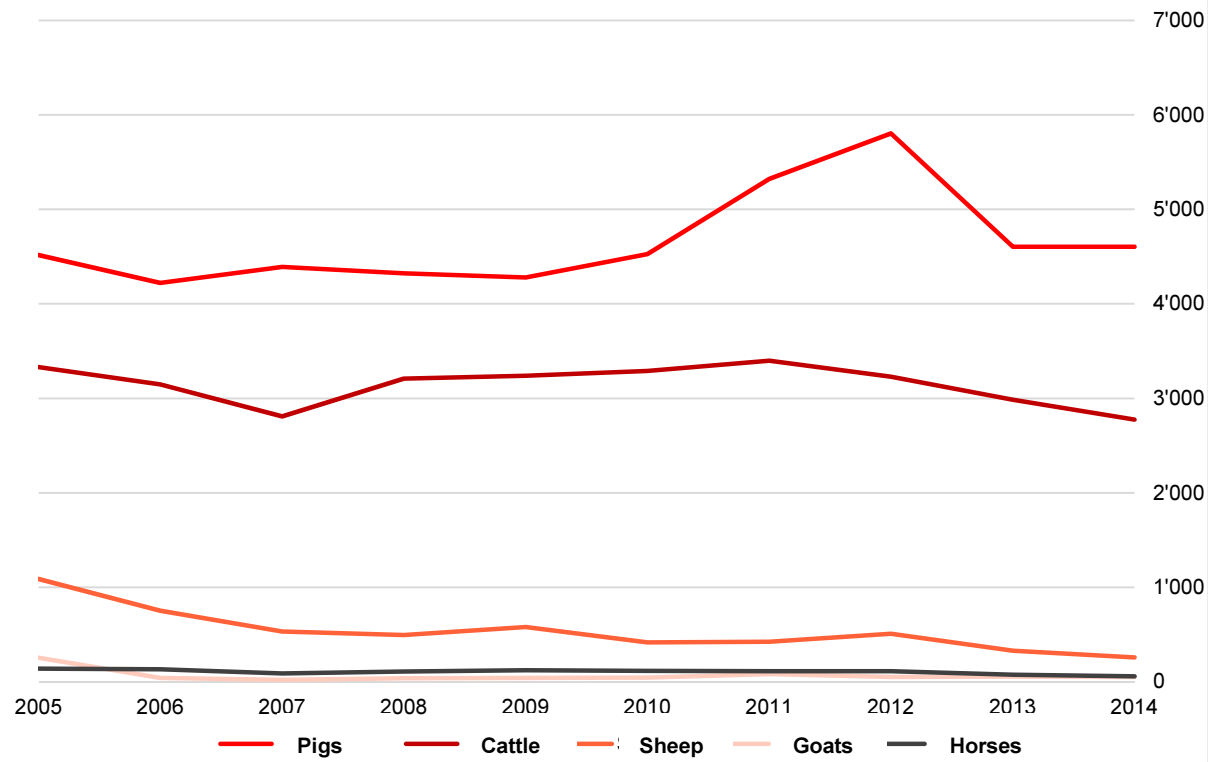


Figure 5.a: Diagram of reasons reported for unfitness for consumption in 2014
Source: Database of the meat inspectorate (Fleko), Identitas



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Pigs	2,608,978	2,712,779	2,801,133	2,782,708	2,645,288	2,711,101	2,846,016	2,827,506	2,763,096	2,680,276	2,742,721
Cattle	638,262	619,291	629,076	612,664	621,376	649,006	650,788	655,985	649,468	647,105	649,357
Sheep	288,862	273,084	265,291	249,547	245,940	238,683	242,818	241,934	227,655	218,362	218,896
Goats	28,126	33,201	27,605	29,730	31,948	27,883	28,320	30,715	32,431	31,242	33,953
Horses	4,251	3,836	3,718	3,221	2,971	3,269	3,051	3,115	3,409	3,195	2,897

Figure 5.b with table: Number of animals slaughtered per year, 2005–2014
Source: Database of the meat inspectorate (Fleko), Identitas



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Pigs	4,517	4,223	4,391	4,322	4,280	4,526	5,321	5,802	4,603	4,605
Cattle	3,332	3,148	2,810	3,208	3,239	3,292	3,398	3,231	2,984	2,777
Sheep	1,089	754	535	497	582	419	425	508	329	258
Goats	256	43	23	39	43	46	84	51	57	54
Horses	140	133	90	111	125	117	112	112	75	58

Figure 5.c with table: Number of results from the meat inspectorate showing a finding of "unfit for consumption" 2005–2014
Source: Database of the meat inspectorate (Fleko), Identitas

	2013	2014	Change [%] compared with 2013
Broiler chickens [t]	76,769	81,436	+6.08
Turkeys [t]	1,459	1,450	-0.62
Total [t]	78,228	82,886	+5.95

Table 5.d: Volume of poultry slaughtered in tonnes, comparison between 2013 and 2014
Source: Agricultural policy information system AGIS, Federal Office of Agriculture (FOAG)

6 Animal health statistics

Animal diseases and suspected animal disease symptoms must be notified to the veterinary service. All current cases are published by the Swiss Federal Food Safety and Veterinary Office (FSVO) in the information system for cases of notifiable diseases (InfoSM). An important event for the Swiss Veterinary Service in 2014 was an outbreak of porcine reproductive and respiratory syndrome (PRRS), which, thanks to comprehensive investigations and the implementation of suitable measures - was quickly brought under control and eradicated. As it proved impossible to determine the cause of the outbreak, a more intensive screening programme for PRRS is being carried out in 2015.

6.1 Statutory framework for the notification of animal diseases and the compilation of animal disease statistics

The obligation to report diseases or suspected disease symptoms is laid down in Article 11 of the Swiss Animal Diseases Act (TSG, CC (Classified Compilation) 916.40) and in the Animal Diseases Ordinance, Article 61 (TSV, CC 916.401). Animal health statistics are governed by the Statistical Investigation Ordinance (CC 431.012.1).

6.2 Animal health statistics

In the Information system for cases of notifiable diseases (InfoSM) the Federal Food Safety and Veterinary Office (FSVO) publishes all of the latest cases of notifiable animal diseases and zoonoses in animals. The system can be consulted at any time and includes facilities to view the data by region or chronologically. The FSVO also publishes a set of weekly statistics about animal diseases. In this report, the annual overview can be viewed by month in **Table 6.a,** and by canton in **Table 6.b**. The following explanations must also be taken into account with regard to animal disease notifications that are of special significance:

Cattle:
During the course of the official screening programme for Infectious Bovine Rhinotracheitis (IBR), a cow was tested and confirmed to have positive serology results for the condition. That cow was slaughtered. During the course of the measures carried out in accordance with the Animal Diseases Ordinance and in other investigations, neither viruses nor any other serological reagents were detected. The cow that tested positive during the screening programme for IBR therefore concerned a “serological singleton reactor”, which are sometimes found in isolation during screening programmes for IBR. These singleton reactors do not jeopardise Switzerland's status as being free of the disease. Investigations are extremely costly in terms of time and effort. On the one hand, the fact that singleton reactors are detected demonstrates the risk that the disease is sometimes brought into the country. On the other hand, however, it also shows that genuine outbreaks will be discovered during the screening programme.

Pigs:
The three cases of Porcine Respiratory and Reproductive Syndrome (PRRS) formed part of an outbreak of PRRS. This was discovered on the basis of serologically positive tests in fattened pigs examined during the screening programme. The investigative tests carried out during the screening programme were extremely comprehensive. Thousands of pigs from several hundred farms were examined. During the course of the tests, the PRRS virus was detected in a single breeding unit. The precise cause of the outbreak could not be determined. As a result of carrying out all of the measures laid down in the Animal Diseases Ordinance and all other investigations, the outbreak was successfully contained and confined to the three farms in question. Extensive and costly examinations were required in this instance, not

only to combat the outbreak, but also to prove that the outbreak had been successfully eradicated and that no other infected herds existed. In order to restore the level of certainty that can be applied to the country's disease-free status to the level of certainty that applied before the outbreak, the screening programme for PRRS is being intensified in 2015.

Animal disease																																				
month *	Swine actinobacillosis	Bovine viral diarrhoea (Mucosal Disease)	Campylobacteriosis	Caprine arthritis/encephalitis	Enzootic abortion of ewes	Avian chlamydiosis	Q Fever	Echinococcosis	Enzootic pneumonia of swine	Equine viral arteritis	American foulbrood	Infectious bovine rhinotracheitis	Infectious haematopoietic necrosis	Avian infectious Laryngotracheitis	Infectious pancreatic necrosis	Cryptosporidiosis	Leptospirosis	Listeriosis	Ovine pulmonary adenomatosis	Maedi-Visna	Neosporosis	Paratuberculosis	Porcine reproductive and respiratory syndrome	Caseous lymphadenitis of sheep and goats	Blackleg	Salmonella infections of fowl and swine (since 2007)	Salmonella infections	European foulbrood	Toxoplasmosis	Trichinellosis	Bovine tuberculosis	Tularemia	Varrosis	Rabbit haemorrhagic disease	Viral haemorrhagic septicaemia	Yersiniosis
1	2	1	12		8		4	1			1					5		2		1	1	3	1	2			2	1		1	1					
2	1	4	7	2	17	1	4	1								7					4	5	1	1			2									
3			14		11		4	1		1	1					2		2	1		3	1	1	2		1	5	2	1			1			1	1
4		3	13		3		2				10					2				1	2	2		1		2	4	47		1	1		1			1
5		4	8				7				12	1				2		2	1		2	4		2			6	73					2			
6	1		8		1		3	1		1	27			1		1					4							155		1			2			
7	1	2	24		1		6	1			1			2		2		2	1		4			1	1	1	9	52						1		
8		9	8				8		3		11		1		1	2			1	1	5	2					7	50		1			6			
9		3	19	1		1	4		1		4			1		4	1	1			5	5				1	9	23					4			
10			29		3		6	1	5		7			1		4	1		2	1	4	2		1	1		9	29				2	2			1
11	1	9	13		3	1	5	1	1							3					4	3		4	1	2	7	3		1		1	2			
12		5	9		3		5	2		1	2			1		1					4					4	3					1				
2014	**6**	**40**	**164**	**3**	**50**	**3**	**58**	**9**	**10**	**3**	**76**	**1**	**1**	**6**	**1**	**35**	**2**	**9**	**6**	**4**	**42**	**27**	**3**	**14**	**3**	**11**	**63**	**435**	**1**	**5**	**2**	**5**	**19**	**1**	**1**	**3**
2013	16	65	83	5	56	4	68	11	2	1	45	1	2	20	5	39	2	8	5	4	59	28	0	22	5	4	73	484	3	2	14	3	8	4	0	6

Table 6.a: Overview of the animal disease statistics for 2014, sorted by month * Month: Notification date of the cantons
Data correct as at: 27.02.2015 / Number of cases from 01.01.2014 – 31.12.2014

	Animal disease																																			
Canton of:	Swine actinobacillosis	Bovine viral diarrhoea (Mucosal Disease)	Campylobacteriosis	Caprine arthritis/ence-phalitis	Enzootic abortion of ewes	Avian chlamydiosis	Q Fever	Echinococcosis	Enzootic pneumonia of swine	Equine viral arteritis	American foulbrood	Infectious bovine rhi-notracheitis	Infectious haema-topoietic necrosis	Avian infectious La-ryngotracheitis	Infectious pancreatic necrosis	Cryptosporidiosis	Leptospirosis	Listeriosis	Ovine pulmonary ade-nomatosis	Maedi-Visna	Neosporosis	Paratuberculosis	Porcine reproductive and respiratory syn-	Caseous lymphadeni-tis of sheep and goats	Blackleg	Salmonella infections of fowl and swine	Salmonella infections	European foulbrood	Toxoplasmosis	Trichinellosis	Bovine tuberculosis	Tularemia	Varrosis	Rabbit haemorrhagic disease	Viral haemorrhagic septicaemia	Yersiniosis
AG	2	1						2	1		5			1				1	1		1	1		1		2	2	14								
AI		1					2																				2	1								
AR					2		1		1																											
BE		2	21		5	1	21	3		1	7					5	2	1	2		8	3		1	2		8	111	1	3						
BL			1																		1							40				1				
BS			3					2																			8					1				1
FL																								4				2								
FR		9	1		4		14	1		1	3			2		10				1	2	3			1	4	4	1					7			
GE			7	1										1		1										1	1									
GL	1																			1								8								
GR		3			14		1				11										3							35								
JU		7	4		1		5							2		1						2														
LU		2	26		2		5				4					1		1		1	16	3	1			1	8	62								1
NE	1		1		1		5						1		1	2		1					1				4							1		
NW					2																														1	
OW											1																	3								
SG		8	5						1		3	1						3	2		2	1		1			2	37			1		1			
SH			1						1													3					2	1								
SO			17													2		1						1			1	6				3	1			
SZ		1			5		1				4										3	1						8								
TG					2				5		14										2							51								
TI					6		1				4																	1								
UR				1	2																		1					3								
VD	1	4	25		1	1	1				9					9		1			1	8		1		3	7			2	1		2			1
VS		1	7	1	1			1			3					1			1	1				1			3	11								
ZG																												2								
ZH	1	1	45		2	1	1		1	1	8					3					3	2		4			11	38					8			
CH	**6**	**40**	**164**	**3**	**50**	**3**	**58**	**9**	**10**	**3**	**76**	**1**	**1**	**6**	**1**	**35**	**2**	**9**	**6**	**4**	**42**	**27**	**3**	**14**	**3**	**11**	**63**	**435**	**1**	**5**	**2**	**5**	**19**	**1**	**1**	**3**

Table 6.b: Overview of the animal disease statistics for 2014, sorted by canton Data correct as at: 27.02.2015 / Number of cases from 01.01.2014 – 31.12.2014

6.3 Switzerland's disease-free status

Proof of the country's disease-free status is provided by adopting a variety of methodological approaches. In addition to compulsory notification in the event of an outbreak, the screening of aborted foetuses and meat controls, risk-based random sampling is also carried out (in accordance with CC 916.401; Article 130). **Table 6.c** sets out which animal diseases do not exist in Switzerland.
When carrying out tests of random samples, the scope of the random sample is dictated by the requirement that it is possible for an incidence of infection of 0.2% of stock to be determined with a 99% degree of certainty. Which animal diseases can be verified by means of risk-based random sampling is described in detail in Chapter 8.

	Approval by				Based on
	OIE	EU[1]	Self-declaration according to OIE-code		
African swine fever			x		b
Aujeszky\'s disease		x[2]			c (2001)
Bovine brucellosis		x			c (only 1997) / d
Caprine and ovine brucellosis		x			c (1998) / d
Lumpy skin disease			x		b
Enzootic bovine leukosis		x			c (1994)
Highly pathogenic avian influenza			x[3]		a (1930)
Infectious bovine rhinotracheitis		x[4]			c (1994)
Infectious salmon anaemia		x			b
Classical swine fever	x				a (Pigs: 1993 Wild boars: 1999)
Contagious bovine pleuropneumonia	x				a (1895)
Foot and mouth disease	x				a (1980)
Newcastle disease			x[5]		a (2011)
„Peste des petites ruminants“	x				b
Porcine reproductive and respiratory syndrome			x		c (2006) / d
African horse sickness	x				b
Rift Valley fever			x		b
Rinderpest	x				a (1871)
Sheep pox and goat pox			x		b
Rabies	x				a (1999)[6]
Bovine tuberculosis		x			c (only 1997) / e
Vesicular stomatitis			x		b
Swine vesicular disease			x		a (1974)

a Disease eradicated since (year of most recent outbreak)
b Disease never detected (historically disease-free)
c Surveillance system based on risk-based random sampling since (year)
d The screening of aborted foetuses for surveillance purposes (in accordance with Directive 64/432/EEC and/or in accordance with CC 916.401, Article 129)
e Meat control tests for surveillance purposes (in accordance with Directive 64/432/EEC)

1) Agreement between the Swiss Confederation and the European Community on trade in agricultural products (CC 0.916.026.81)
2) In accordance with EU Commission Decision 2008/185/EC, Switzerland is entitled to require additional guarantees on the importation of domestic pigs.
3) Applies to HPAI in commercial poultry
4) In accordance with EU Commission Decision 2004/558/EC, Switzerland is entitled to require additional guarantees on the importation of cattle: isolation for at least 30 days and testing using individual animal serology tests for IBR no sooner than 21 days following isolation, with a negative test result
5) In accordance with EU Directive 2009/158/EC, Switzerland is entitled to require additional guarantees on the importation of domestic poultry: amongst other requirements, the poultry may not have been vaccinated against Newcastle disease
6) The most recent case occurred in an imported dog in 2003.

Table 6.c: List of animal diseases that are not present in Switzerland at the present time

7 Diagnosis of epizootics

Recognised laboratories carried out almost 20% fewer investigations into epizootics in 2014 (compared with the previous year). Livestock were sampled the most, particularly cattle. The most common reasons for investigation were national control programmes and official spot checks. Investigations into sickness, death and abortion accounted for only a small percentage of inspections. Although the quality of data supplied to Alis was improved in 2014, 11.2% of data sets were forwarded without the abbreviation for the canton, which means that they are not available to the cantons for use.

7.1 Organisation of diagnosis of epizootics in Switzerland

The combating of epidemics and the monitoring of zoonoses are among the key tasks of the Federal Food Safety and Veterinary Office (FSVO).
Official diagnosis of epizootics includes:

a. Investigations into suspected cases on behalf of the veterinary authorities;
b. National monitoring and control programmes;
c. Monitoring of imports of animals by the official veterinarians;
d. Official health certificates for national and international exhibitions and the transportation of animals;
e. Assignments for the Swiss office for the early detection of epizootics (prevention).

A laboratory needs to be officially recognised in order to carry out official inspection work (Article 312 of the Swiss Animal Health Ordinance (TSV) of 27 June 1995; TSV; SR 916.401). A total of 25 recognised laboratories, both state-owned and private, were involved in the diagnosis of epizootics on behalf of the Swiss Veterinary Service in 2014 (**Figure 7.a**). Along with the Institute of Virology and Immunology (IVI) and the Bee Research Centre at Agroscope Liebefeld-Posieux, which are government institutions, 10 other university laboratories, 7 cantonal laboratories/laboratories that are affiliated with the cantonal veterinary service and 6 private laboratories have official recognition. Two key requirements for the recognition of laboratories are accreditation in accordance with ISO/EN 17025 and affiliation with the database of the Alis laboratory information system (a network comprising the federal government, the canton and the laboratory). Analysis of these data provides information about how widespread an epidemic is and how much effort is being made with regard to monitoring and control.

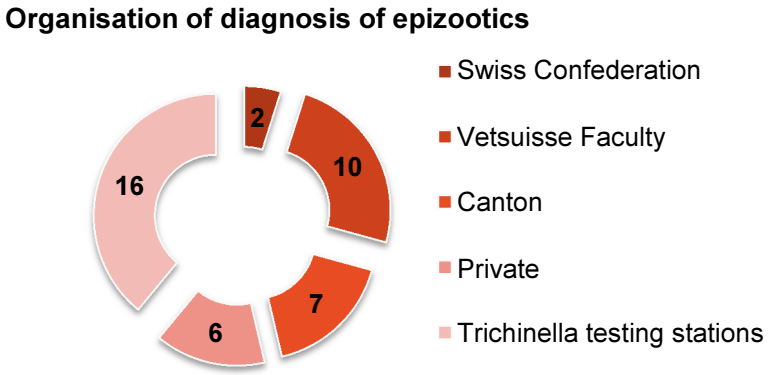


Figure 7.a: Organisation of the 25 laboratories involved in the diagnosis of epizootics on behalf of the Swiss Veterinary Service in the year under review

The two federal government laboratories and the university institutions assume the function of a national reference laboratory (NRL). All epizootics that are regulated by the state in the TSV are assigned to an NRL, to ensure the quality of the diagnosis (confirmations, interlaboratory tests) and competent diagnosis of rare epizootics. **Table 7.a** lists the individual NRLs and their responsibilities and areas of expertise. For investigations carried out as part of the official monitoring of trichinae, the cantons named 16 inspection sites at slaughterhouses, butcheries and private veterinary practices, in addition to the recognised laboratories.

National reference laboratory	Epizootics and other areas of expertise
Institute of Virology and Immunology (IVI), Mittelhäusern site http://www.ivi.ch	Highly infectious epizootics in accordance with Article 2 TSV; blue tongue disease, haemorrhagic disease in deer, porcine reproductive and respiratory syndrome, West Nile fever
	"Emerging diseases"
Institute of Virology and Immunology (IVI) Site at the Vetsuisse faculty of the University of Bern 3012 Bern http://www.ivv.unibe.ch/	Bovine viral diarrhoea/mucosal disease, caprine arthritis encephalitis, Maedi Visna, enzootic bovine leukosis, equine infectious anaemia, equine arteritis, pulmonary adenomatosis, rabies, equine encephalomyelitis, incl. Japanese encephalitis virus
Institute of Veterinary Bacteriology Dept. of National Centre for Zoonoses, Bacterial Animal Diseases and Antibiotic Resistance (ZOBA), Vetsuisse faculty at the University of Bern, http://www.vbi.unibe.ch/	Actinobacillosis, contagious equine metritis, brucellosis in various species, campylobacteriosis, enzootic pneumonia in pigs, infections with Campylobacter foetus, contagious agalactia, leptospirosis, listeriosis, contagious bovine pleuropneumonia, contagious ovine and caprine pleuropneumonia, anthrax, blackleg, *Salmonella* infection in poultry and pigs, salmonellosis, tularaemia, yersiniosis
	Antibiotic resistance
Institute of Veterinary Bacteriology National reference centre for poultry and rabbit diseases (NRGK), Vetsuisse faculty at the University of Zurich, http://www.nrgk.ch/	Avian chlamydiosis, fowl pest, infectious laryngotracheitis in chickens, myxomatosis, Newcastle disease, *Salmonella* infection in poultry and pigs, viral haemorrhagic disease in rabbits
Centre for Fish and Wildlife Health Depart. of Infectious Diseases and Pathobiology (DIP), Vetsuisse faculty at the University of Bern, http://www.vetsuisse.unibe.ch/fiwi/	Spring viraemia of carp, infectious anaemia of salmonids, infectious haematopoietic necrosis, infectious pancreatic necrosis, crayfish plague, proliferative kidney disease in fish, viral haemorrhagic septicaemia
Research facility at Agroscope Liebefeld-Posieux, Centre for Bee Research (CBR), http://www.agroscope.admin.ch/bienenforschung/index.html?lang=de	Acariasis, varroatosis, infestation with Tropilaelaps mites and *Aethina tumida*, European foulbrood, American foulbrood
Institute of Veterinary Bacteriology Vetsuisse faculty, University of Zurich, http://www.ivb.uzh.ch/	Coxiellosis, paratuberculosis, pseudotuberculosis, glanders, tuberculosis
Institute of Parasitology at the University of Bern http://www.ipa.vetsuisse.unibe.ch/	Dourine, besnoitiosis, infections with *Tritrichomonas foetus*, neosporosis, toxoplasmosis, trichinellosis
Institute of Parasitology at the University of Zurich http://www.paras.uzh.ch/index.html	Echinococcosis, cryptosporidiosis, hypodermosis
	Vector entomology
Virology Institute Vetsuisse faculty at the University of Zurich http://www.vetvir.uzh.ch/	Infectious rhinotracheitis/infectious pustular vulvovaginitis, Aujeszky's disease, transmissible gastroenteritis
NeuroCenter, Depart. of Clinical and Experim. Research & Veterinary Public Health Vetsuisse faculty at the University of Bern http://www.neurocenter-bern.ch/	Bovine spongiform encephalopathy (BSE), scrapie
Institute of Veterinary Pathology Vetsuisse faculty, University of Zurich http://www.vetpathology.uzh.ch/	Enzootic abortion in sheep and goats
Institute of Food Safety and Hygiene, Vetsuisse faculty at the University of Zurich, http://www.ils.uzh.ch/	Verotoxin-producing *Escherichia coli*

Table 7.a: National reference laboratories and their responsibility for certain epizootics

7.2 The laboratory information system

Since 2003, the recognised laboratories for official diagnosis of epizootics have reported their laboratory tests regularly to a database of the FSVO (formerly the Federal Veterinary Office). Having initially been used mainly for statistical purposes (reporting within the framework of national and international reporting systems), the laboratory data were directly linked with the cantons' ISVet information platform for the first time in 2008 as part of the bovine viral diarrhoea (BVD) control campaign. This made the laboratory results immediately available to the cantons to enable them to initiate measures (ban on animals or companies). The laboratory database (ILD) that had been used up to then, which had become outdated from a technical viewpoint and no longer met current requirements for efficient use, was replaced by the new Alis laboratory information system from 1 November 2013, following a 3-year project phase. When a new database was designed for all laboratory tests required as part of the officially decreed diagnosis of epizootics (initial and confirmation tests), the main focus was on the possibility of making laboratory results available to the sponsor (cantonal veterinary office) quickly. Another new feature introduced with Alis is validity checks (technical) and plausibility checks on the forwarded data sets directly during the reporting process. Data that do not comply with certain defined rules are judged by the system to be non-plausible and must be corrected independently by the laboratory that reported them. Compliance with these two specifications was ensured from a technical viewpoint by developing the sub-system "Alis in Asan" on the Agate portal for access by cantonal employees and the laboratory staff responsible, in addition to the actual "Alis" database. So that this functional cooperation between the laboratory, the canton and the FSVO can be used in a meaningful way, the quality of the data (completeness for the purposes of traceability) and frequency of reporting (forwarding on a daily basis) must meet high standards. With regard to livestock in particular, this requires those responsible for sampling and sending to have greater discipline in stating company and animal identification, and involves more work by recognised laboratories in reporting and correcting data.
Another requirement of the new laboratory information system was the possibility of extending it to all laboratory data along the food chain. As well as laboratory data relating to the diagnosis of epizootics, more than 500,000 tests linked to the legal inspection of milk are now reported in Alis.

7.3 Investigations into epizootics in 2014

7.3.1 Investigations carried out by recognised laboratories

Recognised laboratories reported a total of 317,082 pieces of laboratory data regarding 69 epizootics to the Alis laboratory information system in 2014. Investigation figures are thus down almost 20% compared with the previous year, and for a few years have been steadily growing closer to the figures from before the high levels of investigation activity due to the eradication of BVD from 2008 onwards (**Figure 7.b**). The significant decline in overall investigation figures since 2012 is therefore largely attributable to the sharp reduction in testing as part of BVD monitoring, due to a change from sampling of all newborn calves to serological monitoring via bulk tank milk testing or the testing of samples from companies that do not supply milk. This trend also continued in 2014 (**Figure 7.d**; approx. 35% fewer tests for BVD than in 2013). While laboratory data from BVD monitoring accounted for almost 47% of all reported tests in 2013, by 2014 this had dropped to 36.4% (n = 115,547) of all laboratory reports in Alis.

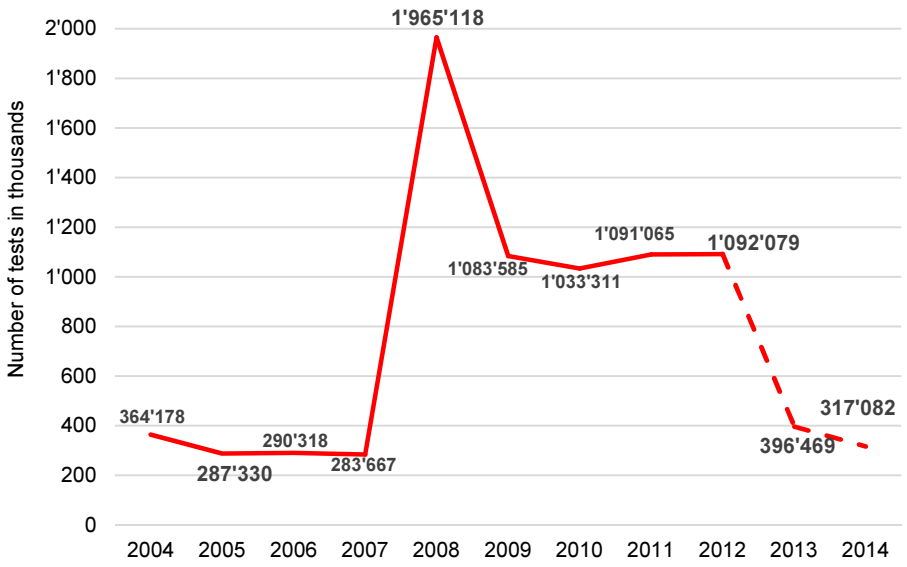


Figure 7.b: Test figures reported by recognised laboratories to the laboratory information system in 2004–2014

As **Figure 7.c** shows, Alis typically experiences a peak in reports in the spring months (February to April), as this is the main season for nationwide testing of samples to provide proof of freedom from certain epizootics (infectious bovine rhinotracheitis (IBR/IPV), enzootic bovine leukosis (EBL), blue tongue disease (BT), Aujeszky's disease (AUJ), porcine reproductive and respiratory syndrome (PRRS)). Several PRRSV-seropositive pig holdings were identified during these investigations, and evidence of the virus was found at two companies. The slight rise in reports in October 2014 can be explained by an increase in investigation activity due to the extension of PRRS monitoring, particularly at the core breeding companies in the late summer.

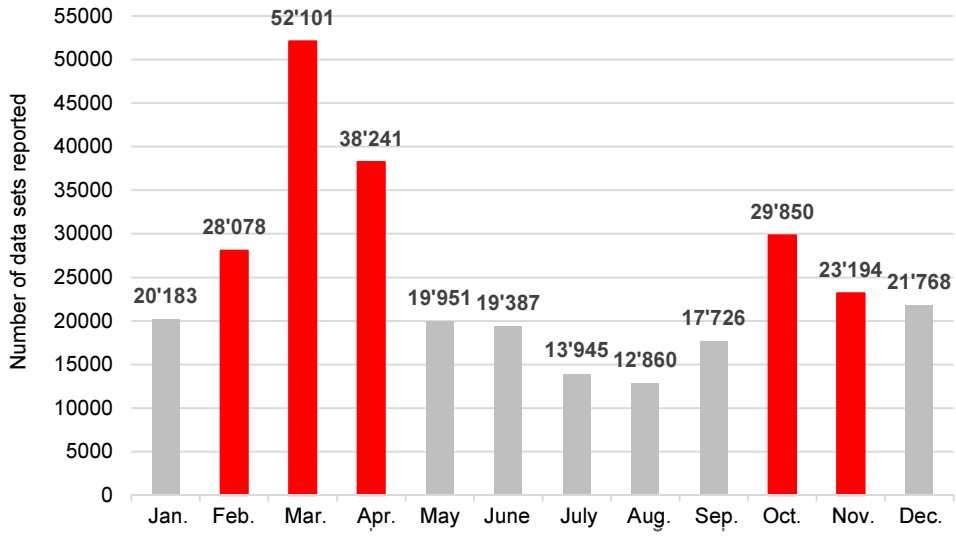


Figure 7.c: Test figures reported by recognised laboratories in 2014, shown month by month

7.3.2 The 12 most-investigated epizootics

By looking at the most frequently investigated epizootics, we can show and explain annual fluctuations. As already mentioned at the beginning of Chapter 7.3.1, the test figures reported in Alis in 2014 were down around 20% compared with the previous year. We have already described the changes in the combating of BVD and their impact on overall test figures (see Chapter 7.3.1). The reduction in reported test figures for salmonellosis (-47%), in contrast to an increase in *Salmonella* infections in poultry (+45%) in 2014 (**Figure 7.d**) could be explained at least partly by more detailed reporting specifications in the Alis laboratory information system that has now been introduced. The fact that tests for *Brucella melitensis* in sheep and goats were reduced by half compared with the previous year (-54%) was due to a much higher number of samples per selected company in 2013. The serum bank was deliberately topped up with blood samples from small ruminants at that time. The reduction in tests for bovine spongiform encephalopathy (BSE) (-24%) was due to the raising of the age for examination of cattle slaughtered while ill and fallen cattle following the amendment of the Swiss Animal Health Ordinance in July 2013 and the cessation of the monitoring of healthy animals for slaughter. Since the full examination for caprine arthritis encephalitis (CAE) in 2011/12, the figures for tests carried out on a voluntary basis have fallen continuously each year (-70% compared with 2013).

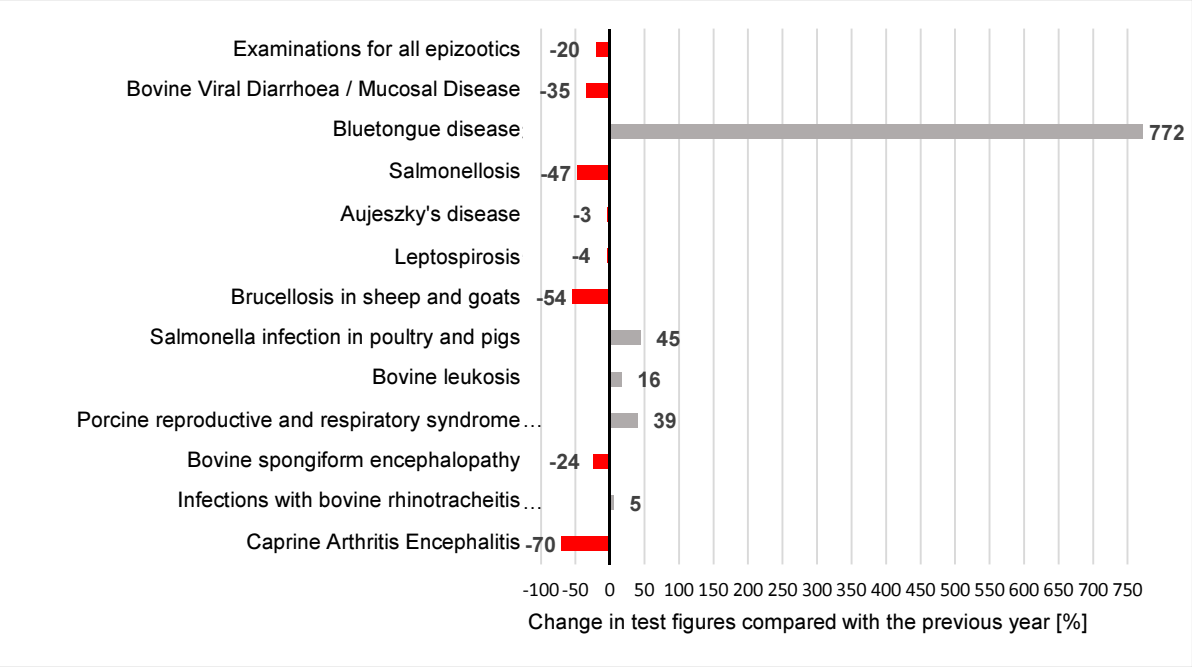


Figure 7.d: Comparison of the number of tests in 2014 with the previous year in percent. The chart shows the 12 most common epizootics.

On the other hand, a programme to monitor the cattle population in Switzerland for blue tongue disease was launched in 2014 following a 3-year suspension; in accordance with international standards, this included around 3,000 samples, as planned. We have also already mentioned the extended monitoring for PRRS at core breeding companies for pigs, which was largely responsible for the increase of +40% in test figures.
The following illustrations (**7.e**) show trends in testing for the 10 most common epizootics (excluding BVD and BSE) over a period of 10 years.

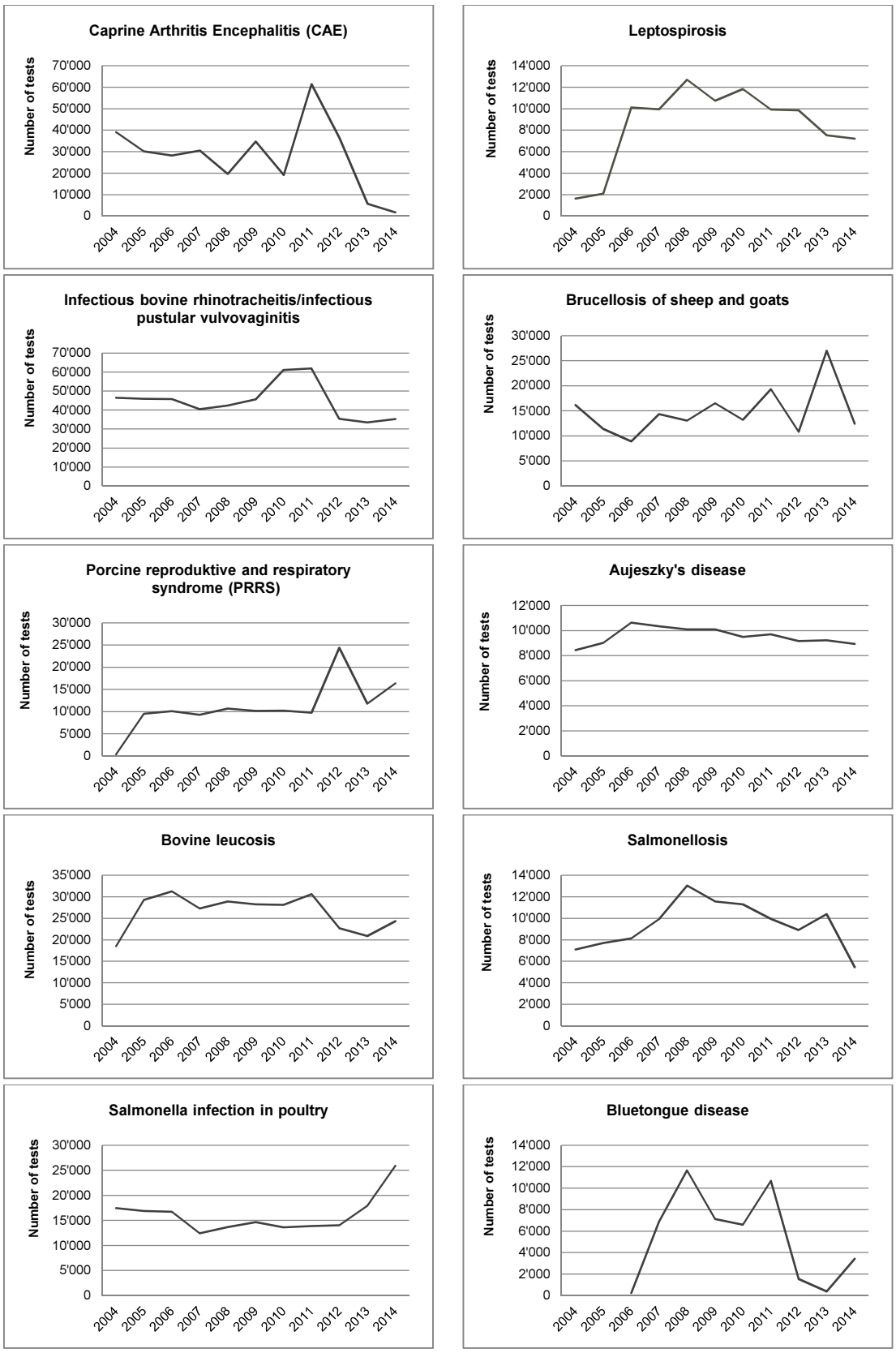


Figure 7.e: Changes in the number of tests for the 10 most common epizootics in 2014 (excluding BVD)

7.3.3 Animal species, reason for examination and methods used

In the year under review, 95% of all reported tests were on various species of livestock. Tests on cattle came out on top, accounting for around two-thirds of all reports (**Figure 7.f**), followed by pigs (11%), poultry (9%) and goats/sheep (7%).

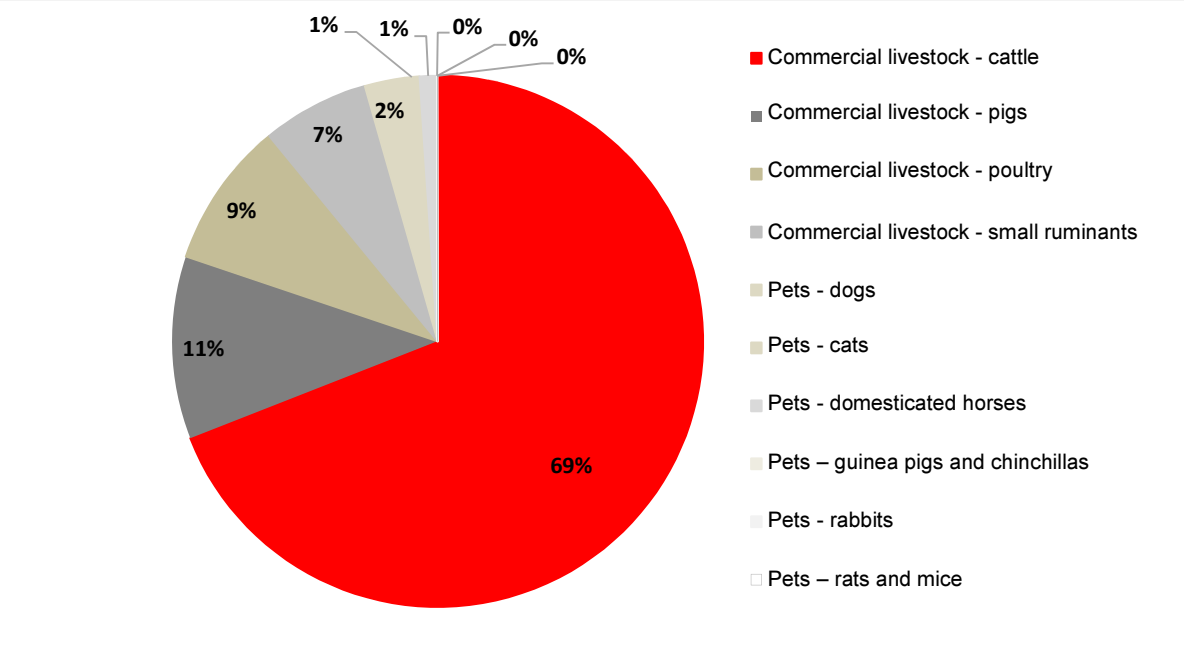


Figure 7.f: Distribution of species examined in percent

Almost 62% of reported tests were commissioned as part of national inspection programmes (**Figure 7.g**). As well as national programmes to control BVD, CAE, BSE and *Salmonella* infections in poultry, these include, for example, official testing of samples to provide proof of freedom from IBR, EBL and BT in cattle, PRRS in pigs and brucellosis in small ruminants. As described under 6.3.2, these are among the most frequently investigated epizootics.
Investigations that are prescribed in accordance with the law on epizootics also include examinations of contagious abortions in various species (cattle, sheep, goats, pigs), which account for about 7% of reported laboratory data. So-called health checks, which account for 6.7% of tests, are carried out on a clinically healthy population. These may be prescribed by law (e.g. the monitoring of breeding animals in insemination stations, stallions, etc.), ordered additionally by certain label organisations (e.g. organic) or carried out voluntarily. Laboratory data generated and reported in connection with trade and the transportation of animals account for around 6%.
Compared with official inspections to monitor healthy animals, the investigations forwarded to Alis regarding cases of sickness, causes of death and the slaughtering of sick animals, including the investigations into abortions mentioned above, account for a relatively small proportion of tests (18%).
Most of the monitoring programmes are carried out using serological methods. As a result, the materials submitted for testing (**Figure 7.h**) consist primarily (73%) of blood samples (full blood and serum) and bulk tank milk and, to a small extent (3%), of eggs (to provide evidence of Salmonella antibodies in poultry). The remaining 27% consists partly of disease-specific samples such as brain stem (4%) to provide evidence of BSE, faeces (4%) for some zoonosis agents and afterbirths (2%) for investigations into abortions. Sample materials such as organs/tissues (5%) and biopsies (2%) mainly include ear punch biopsies taken to test calves for BVD.

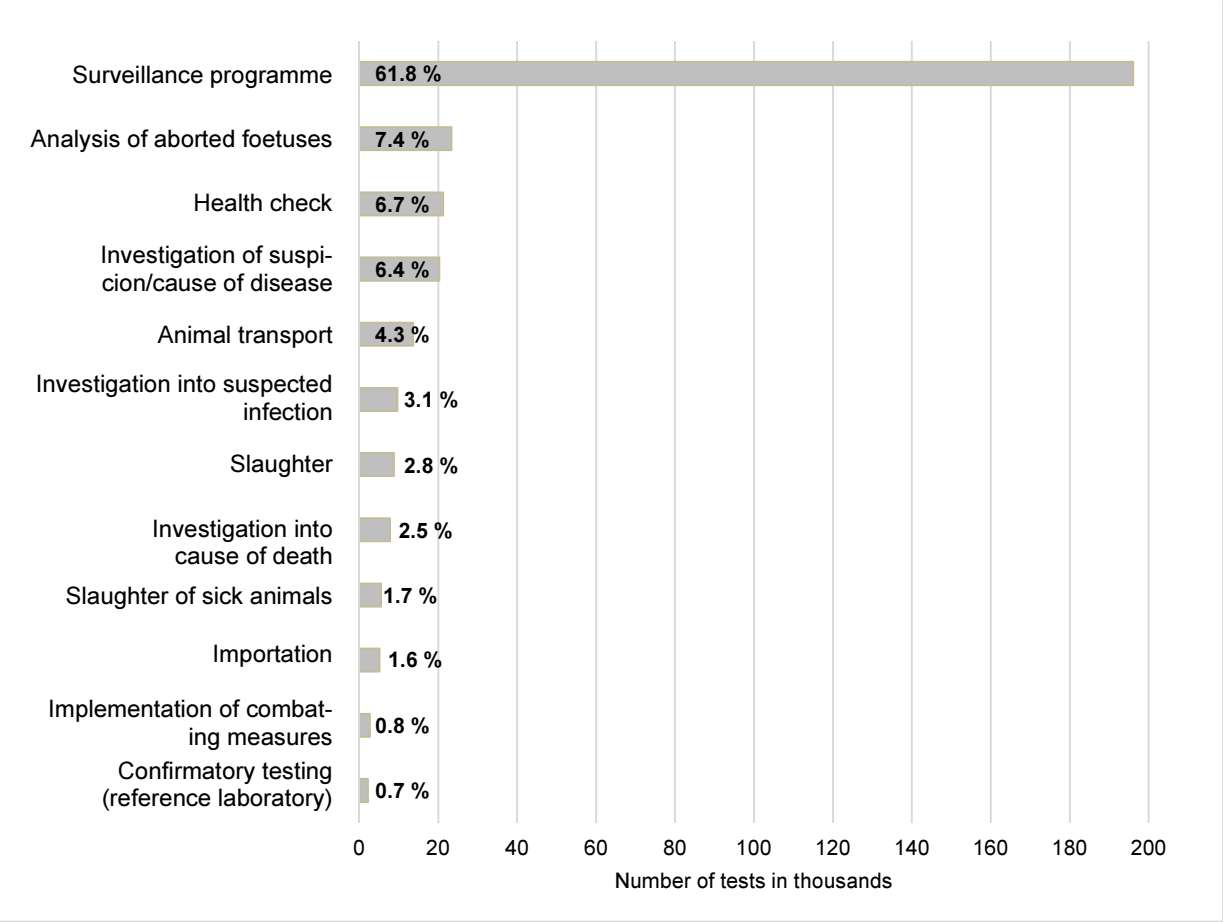


Figure 7.g: Reasons for investigation in percent
[The percentages stated refer to the proportion of the total number of examinations that were carried out for the respective reason]

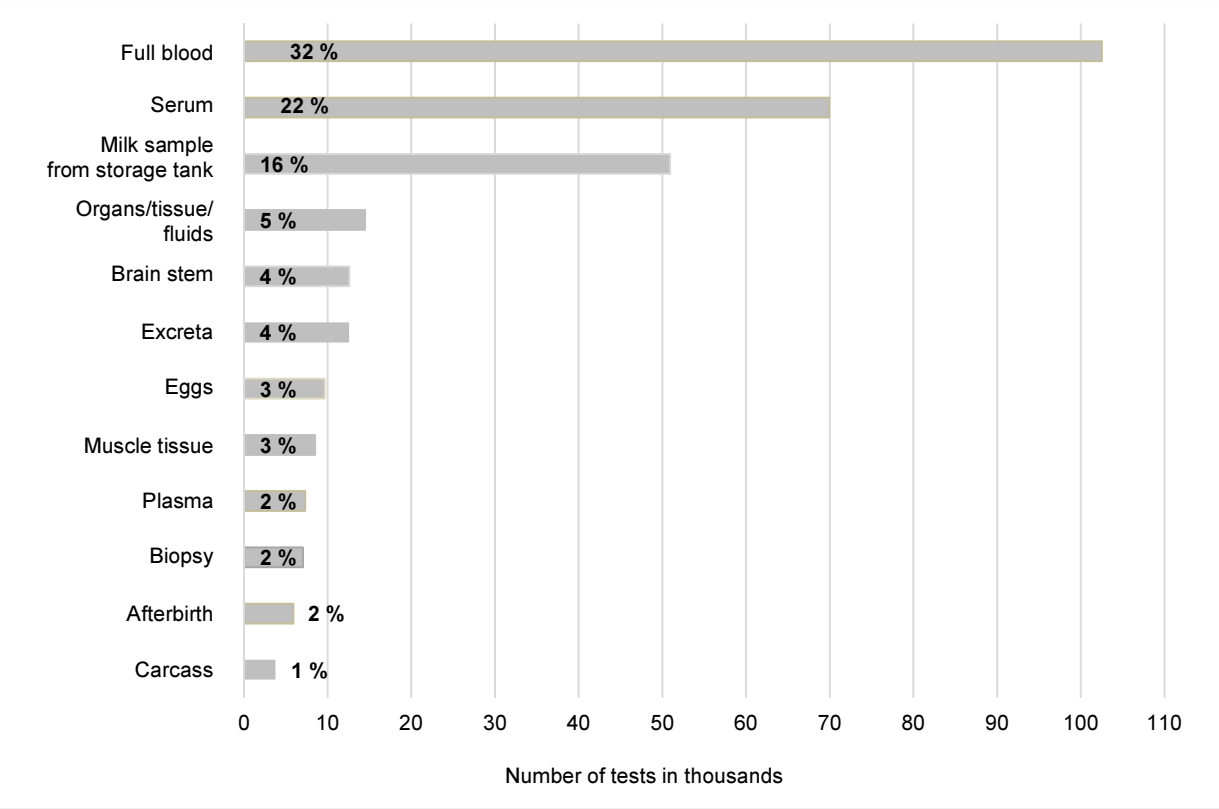


Figure 7.h: Percentage distribution of sample materials
[The percentages stated refer to the proportion of the total number of examinations that were carried out for the respective reason]

Enzyme-linked immunosorbent assay (ELISA) to provide indirect evidence (antibodies) of the presence of an epizootic is clearly the most commonly used method during monitoring (n = 151,330). If we show the number of detection procedures used according to season during the year under review (**Figure 7.i**), we see a peak for ELISA (red) in serological testing of samples in spring and a double peak in spring and autumn for biphasic ELISA, used as part of the investigation of bulk tank milk for BVD at companies that supply milk.

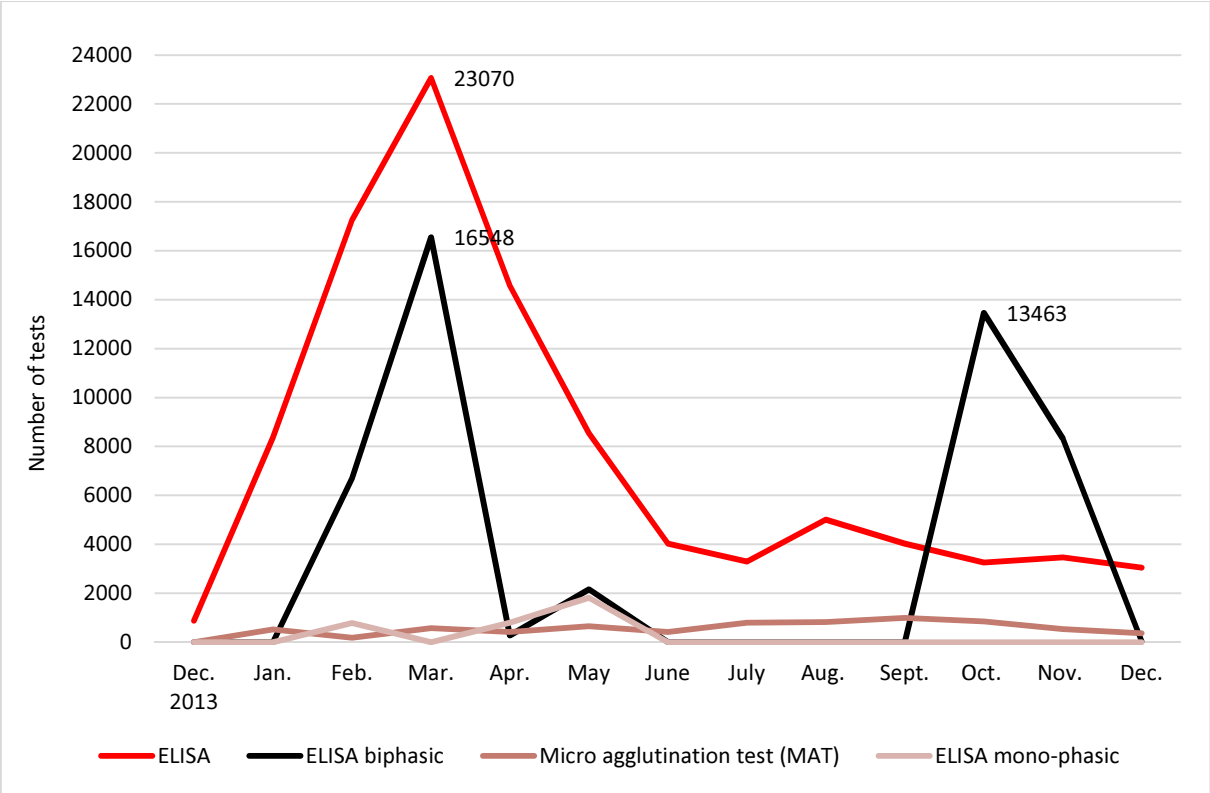


Figure 7.i: Use of serological detection methods according to season

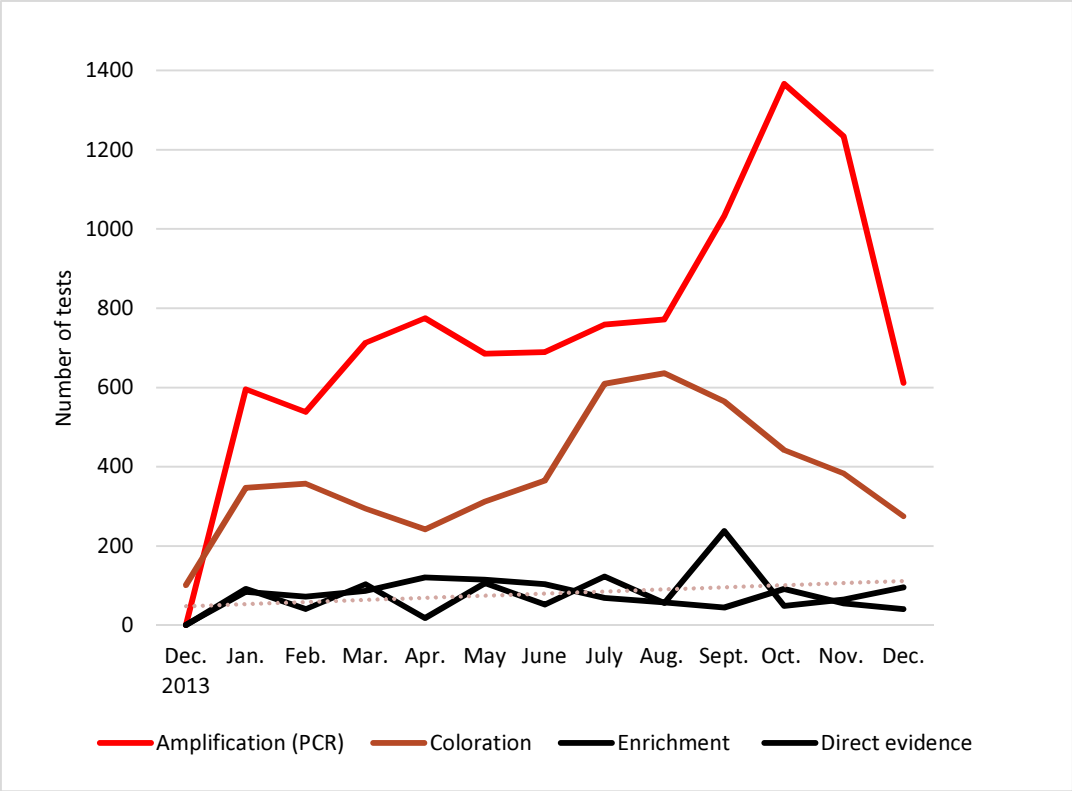


Figure 7.j: Use of different methods to provide proof of pathogens, according to season

Real time PCR was primarily used in 2014, as a quick and sensitive method of providing direct evidence of pathogens (n = 9,772), followed by microscopic evidence (n = 4,827) and cultural evidence (n = 1,982) (**Figure 7.j**). The most common area in which PCR is used as part of the official diagnosis of epizootics is in the examination of ear punch biopsies when testing calves for BVD. The only possible explanation that presents itself for the increased use of PCR from October onwards could be that calves returned from the Alps in September and that sampling began after that.

7.4 Data quality

7.4.1 Non-plausible data sets

To fulfil requirements for the provision of correct and complete data, Alis sets high standards by stipulating specific plausibility rules and mandatory fields. When the introduction of Alis began in 2013, up to 6% of data sets were found to be non-plausible over a period of several months. Through intensive collaboration between the laboratory, the canton and the FSVO, this percentage was brought down to 0.6% for 2014 as a whole. Subsequent corrective work, together with a better overall understanding of the specifications and function of Alis among users, led to a continuous improvement in the quality of data throughout the year.
Missing, incorrect or incorrectly entered earmark numbers on cattle continue to account for the highest proportion of non-plausible data sets. Under certain circumstances, these cannot be recorded retrospectively and the data sets cannot be corrected and thus remain non-plausible. Non-plausible data currently have a detrimental effect on the implementation of legislation in connection with the combating of BVD in particular, as Alis laboratory data are not available to ISVet under these conditions and there is thus no effect on the status of animals or companies.
Data sets containing entries for which there was no Alis code at the time they were forwarded cannot be corrected retrospectively either, even if a code is introduced later. The data set remains non-plausible. One typical example of this is information about types of animals. A total of 276 different types of animals have to date been coded in Alis. 0.02% of the data sets contain no information or information that cannot be used by Alis. Obviously, it is mainly exotic species (2%) that do not yet have Alis codes. However, other input errors that are also common, such as when data relating to sampling, receipt by the laboratory and incidents in the laboratory are not in chronological order, or the absence of a reason for investigation with simultaneous entry of a national inspection programme, etc., can easily be corrected by the laboratory.

7.4.2 Missing canton abbreviation and consequences for the implementation of legislation

Access to the laboratory data forwarded to Alis must be regulated for data protection reasons. The cantonal veterinary authorities can therefore view only the results of those laboratory tests that have been commissioned in their own canton in Asan via Alis. In order for the canton to have access to the results of all official laboratory tests in its territory, the laboratory performing the tests must enter a canton abbreviation when it forwards the data.
In 2014, 35,567 data sets (11.2%) were reported without a canton abbreviation, which means that they are not available to the canton as the sponsor in Asan via Alis for the implementation of legislation. In principle, this can be corrected if a postcode has been provided. If there is a valid number from the business and enterprise register (BER), the postcode is automatically added in Alis.

To automate queries relating to animal and company data and thus make them easier, the FSVO has granted recognised laboratories access to the Animal Tracing Service of Identitas AG through a licence agreement with the Federal Office of Agriculture.

8 Surveillance programme

An important foundation of free trade is the ability to prove the absence of several animal diseases inside the country, on a yearly basis. Any diseases brought across the country's borders must also be detected at an early stage. For that reason, the possible recurrence of previously eradicated diseases has been a focus of the surveillance programmes carried out by means of random sampling since 1995. Since that screening programme began, the country has been able to provide evidence that it is free of major diseases. This serves to protect Switzerland's livestock and secures the quality of the country's products. In 2014, samples were taken at random and examined for infectious bovine rhinotracheitis, enzootic bovine leukosis, porcine reproductive and respiratory syndrome, Aujeszky's disease, brucellosis in sheep and goats and bluetongue disease, in order to prove that the country was free of these diseases.

8.1 Infectious bovine rhinotracheitis

The bovine herpes virus 1 (BHV-1) is the pathogen that causes infectious bovine rhinotracheitis (IBR) and the rarer condition of infectious pustulous vulvovaginitis (IPV). Which of these two types of diseases occurs depends on the route of infection. Cattle are especially susceptible to such infection. Other animals, namely goats, sheep, pigs and various types of wild even-toed ungulates are affected only rarely. It is also important to note that only cattle are capable of transmitting the disease. The disease is not harmful to humans.

IBR is a typical disease of the respiratory tract and manifests itself in the form of high fever, rapid breathing, nasal secretion, coughing and a reddening of the muzzle. In cows, it can lead to abortions and milk output also declines. In calves, the disease manifests itself in the form of trembling muscles, abnormal movement, an inability to stand up and, in rare cases, blindness. This form of the disease occurs if animals become infected with BHV-1 via the air, as a result of direct contact with other infectious animals. Transmission that occurs during service or insemination, however, will lead to the onset of IPV. Typical symptoms of IPV are a reddening of the genital mucous membranes, with millet-sized blisters. The animals will urinate on a frequent basis and will hold their tails in an abnormal position. In contrast to IBR, only individual animals within a herd are usually affected by IPV. Of the two forms of the disease, IBR is by far the more common and the one that has a greater impact from a commercial perspective. That is why, when referring to infections with BHV-1, we generally refer only to IBR.

IBR first occurred in Switzerland in 1977. Following a massive epidemic in 1983, an eradication programme was launched and was successfully completed 10 years later. Since then, Switzerland has carried out a screening programme each year and has provided annual evidence that is free of IBR. IBR still occurs in neighbouring countries, however the eradication programmes that have been underway in those countries for a number of years are achieving increasing levels of success. That is why a growing number of regions within those countries now enjoy the same status as Switzerland itself, namely as being free of IBR. In the case of imports from regions that are not IBR-free, cattle must undergo a special quarantine programme. International trade between IBR-free regions may not be subjected to regulation.

8.1.1 Procedure to provide evidence of disease-free status

In order to prove the absence of an animal disease, there must not be any signs in advance that the disease actually occurs in the area concerned. A condition of this type can only be fulfilled if diseases or suspected incidences of disease are subject to compulsory screening and must be notified to the relevant official bodies (**obligation to report**). If there is a risk that the disease may be brought into the country, it is crucially important to have detailed disease-awareness and an effective means of recognising disease at an early stage. Animals that are displaying the typical, clinical signs of a disease must be examined. This means, for example, that a herd of cattle with a noticeably increased rate of abortion must be screened for IBR. Though the signs will generally be thought to be the result of a different cause, due to the fact that IBR is not endemic in Switzerland, such screening is still necessary, as the disease may be brought in from outside the country at any time. In order to ensure that the risk of importing IBR is kept as low as possible, imports of cattle and cattle semen are subject to stringent import regulations. Furthermore, cattle taking part in national shows, cattle that are sent to market or are admitted to animal clinics, must be screened for IBR. The purpose of all of these measures is to prevent any outbreak from spreading. For the same reason, breeders' associations regularly screen all animals used for insemination.
If all of these screening measures do not reveal any signs of IBR, a sensible step by virtue of the country's bilateral treaties with the EU would be to carry out a screening programme in the form of random sampling, in order to provide evidence that the country is disease-free. As a result of international agreements, the screening programme is necessary in order to regulate the importation of cattle and semen. An important pre-requisite when it comes to ensuring the comparability of the evidence of disease-free status provided by individual regions and countries, is that the quality of surveillance and the results obtained therefrom are comparable, that is, it will be necessary for any statements to be backed up by statistics. The scientific and statistical foundation for the screening programme operated in Switzerland fulfils this requirement.

8.1.2 Calculation of the random sample

The random sample is selected in accordance with statistical principles. These have been published in a scientific journal and are therefore generally acknowledged. They are based upon a random selection of the farms that were tested. Only if the farms to be sampled are selected at random is it possible to extrapolate the results across the population as a whole.
In the years since the screening programme to demonstrate Switzerland's freedom from IBR was introduced, the Federal Food Safety and Veterinary Office (FSVO) has developed and refined additional methods in accordance with the stated principles that enable the random samples to be carried out as effectively as possible. The two most important of those methods are:

- The **risk-based random sample calculation** This gives rise to a situation, in which the calculated number of farms that take part in the random sample each year is lower when compared to the standard method, and

- The **risk-based selection of farms** Under this system, farms that are at increased risk of an outbreak of the disease are selected in a targeted way (these are known as **sentinel farms**). In view of the higher risk that applies in the case of these farms, the number of farms can also be reduced.

Of these two procedures, we have used only the risk-based selection of farms since 2013 in connection with IBR. In doing so, we establish and quantify risk factors as a means of estimating the probability of a disease occurring on a farm (see Section 8.1.3). This then gives rise to **the relative risk of individual farms compared to one another**. This means that a farm with a relatively high risk for the purpose of surveillance counts for more than another farm, which has a lower calculated risk. For example, a farm with three times' the average relative risk can replace 3 farms with a relative risk at an average level.

This means that the number of farms to be tested can be reduced. Farms with a high probability of an outbreak of a disease are referred to as **sentinel farms**. These are included into the random sample in a targeted way. The majority of the farms are still selected on a random basis, however, so that the sample can continue to be regarded as the luck of the draw.
Examining samples collected at random enables the results to be extrapolated across the population as a whole, by means of probability calculations (stochastics). These set out to calculate how likely a certain result will be, if the population is composed in a particular manner. When it comes to providing evidence of disease-free status, it is necessary to determine how likely it is that the result of the random sample will be negative, if a certain number of instances of the disease actually existed within the population. This probability is also referred to as the **certainty of the evidence of disease-free status.** The task to be fulfilled by the screening programme is now to ensure that we are able to detect a certain assumed prevalence within a herd (this is known as the design prevalence), with a defined degree of certainty. In specific terms, this means that an infected farm - amongst several farms assumed to be infected - will be identified within the random sample, with a specific degree of probability. Based on this assumption, we can then calculate the necessary size of the random sample. In the case of IBR, the criteria to be fulfilled in this regard are laid down in the bilateral agreements with the EU. Within a random sample, it is then necessary to demonstrate with 99% certainty that the herd prevalence is lower than 0.2%. The larger the random sample, the higher the degree of certainty that can be associated with the proof of disease-free status.
Two aspects frequently cause confusion, however, and must always be taken into account: The aim of the screening programme is to demonstrate the disease-free status in connection with a particular type of animal disease. For that reason, no cases may be discovered by some other means - such as by examining suspected cases or examinations of aborted foetuses. The assumption that a number of infected farms or animals exist is only made in order to carry out the calculation of the random sample. That assumption is only used as a guide when performing the calculation. It does not mean therefore that a number of infected farms or animals can be discovered outside of the sample, without disease-free status being lost.
The treaty with the EU demands that a screening programme be carried out each year. This is necessary, as the screening can only demonstrate an outbreak of a disease that has already taken place and can only provide an authoritative statement with regard to the preceding year. Nevertheless, we are able to reduce the size of repeat samples, based upon the following assumption: despite import regulations and the inspection of imports, even once evidence of disease-free status has been provided, there is still a very small probability that the disease will nevertheless be brought into the country on any given day. For that reason, the attained level of certainty of disease-free status - that is, the outcome of the screening programme - will decrease as time goes on. We set out to calculate that decrease in the form of a quantitative risk evaluation. The annual repetition of the screening programme is therefore only required to counterbalance that decline in certainty. This procedure is referred to as a **risk-based random sample calculation**. Using this calculation procedure developed by the Federal Food Safety and Veterinary Office (FSVO), we are able to reduce the number of farms screened on an annual basis, in a scientifically-based way.
As the number of farms screened becomes smaller, we are able to reduce the costs of the screening programme, both in the case of risk-based random sample calculation, as well as when using a system of risk-based selection of farms. The difference between each of these procedures is that in the case of risk-based random sample calculation, the annual number of screenings is smaller and therefore offers a lower degree of certainty that any instances of disease will be detected. In the case of the risk-based selection of farms on the other hand, the level of certainty remains the same, despite the reduced number of annual screenings, as the farms being screened are the ones that are at high risk.
During the past few years, a number of IBR outbreaks were discovered in Switzerland, outside of the screening programmes carried out. In order to increase the likelihood that potentially infected farms will also be detected by means of the screening programme, two new approaches were implemented in 2013. On the one hand, in the case of IBR, screening was switched from diagnosis using blood samples to a more cost-effective system in which a diagnosis is established by testing milk stored in a tank. This enabled the number of farms being screened to be increased at the same time. On the other hand, a

proportion of the farms are selected according to the level of risk that applies. We undertook both of these changes, as we set ourselves the target back in 2013, to improve upon the screening programme carried out in 2012, while keeping costs at the same level. During the year under review, the tried-and-tested screening programme adopted in 2013 was retained.
As screening using samples of milk from a tank is much more cost-effective than the testing of blood samples taken from individual livestock that is necessary when testing animals on non-dairy farms, testing only dairy farms would appear to be an attractive option. Nevertheless, proceeding in that manner would severely violate the fundamental principle of selection at random that is applied when collecting the random sample. For that reason, we set the same screening targets for dairy farms and non-dairy farms alike. Taking the entire cattle population as a whole, these targets far exceed the requirements laid down by the EU and increase the degree of probability that the screening programme will detect any IBR outbreaks that exist.
The screening programme for 2014 was designed in such a way that in the case of both sub-populations (dairy and non-dairy cattle farms), it would be possible to achieve 99% certainty that the design prevalence of 0.2% would be detected. When carrying out the calculation in this way and in the case of a given size of the random sample population, a higher design prevalence is detected, with a greater the degree of certainty. When extrapolating from the sub-populations to the population as a whole, one either obtains a very high degree of certainty at a design prevalence of 0.2%, or the design prevalence is almost halved, while the existing degree of certainty, of 99%, remains the same (**Table 8.a**).

Design Prevalence established [%]	**Certainty arising from non-dairy farms [%]**	**Certainty arising from dairy farms [%]**	**Certainty arising from dairy farms [%]**	**This design prevalence corresponds to:**
0.200	99	99	99.99	78 farms
0.103	90	90	99.00	40 farms

Table 8.a: Relationship between certainty and design prevalence, including sub-populations and total population for the IBR random sample carried out in 2015

In addition to categorising dairy and non-dairy farms, it is also necessary within each sub-population to make a distinction between Sentinel farms and farms that were selected at random. To that end, we decided that half of the required certainty should be obtained by examining farms selected at random. The other half would then be obtained by examining Sentinel farms. In view of the stochastic interrelationship, a level of certainty equivalent to 90% would correspond to half of the certainty required in order to reach a certainty level of 99%. This means therefore that 90% of certainty in each case must be obtained from each of the four types of farm. When calculating the number of farms to be included in the random sample, we always include an additional number of farms as a back-up, as it may not be possible for some of the farms selected to be tested as a result of circumstances. **Table 8.b** contains a summary detailing the calculated random sample sizes, population figures and backup farms that have been identified.

Animal disease	**Type of farm**	**Samples**	**Farms in population**	**Number of farms required**	**Sentinel farms**	**Farms selected at random**	**Back-up farms**
IBR	Non-dairy farm	Individual blood samples	15,584	1,100	63	1,037	–
	Dairy farm	Samples of milk stored in tanks	26,516	1,700	67	1,633	100

Table 8.b: Distribution of the selected farms according to type and method of selection

When calculating the size of the sample and in order to achieve a higher quality of surveillance, we decided to forego the possibility of carrying out a risk-based random sample calculation as a means of reducing the number of farms to be checked. Nevertheless, it is also possible to delay applying that method until the evaluation stage.
Since 2012, as a means of evaluating the samples obtained during the random sampling for IBR, we have used a special statistical method, in which the result of the current sample is combined with the data obtained from the sample in the preceding year (**Bayesian method**). In order to calculate the decline in certainty arising from the previous random samples, we carried out an extensive, quantitative risk evaluation over a period spanning several years. Since 2012, we have been using a simplified procedure, in which we evaluate the current sample and take into account a decline in certainty relating to the previous samples of 10% per year, in so far as fewer than 2,500 cattle were imported during the preceding year. This simplified procedure is based upon the data from the quantitative risk evaluation that was carried out over a number of years. In view of the fact that a total of 1,636 cattle were imported during the preceding year, we were able to make use of the simplified procedure when carrying out our review for 2014.

8.1.3 Selection of farms

In the case of the samples taken to test for IBR and EBL, the same farms are selected from the animal transport database and all cattle sampled are screened for both diseases. Farms, from which regular milk samples are taken for milk screening by Suisselab AG in Zollikofen, are regarded as dairy farms, whilst all other farms are regarded as non-dairy farms (**Table 8.c**).
The aim of the screening programme is to enable a statement to be made with regard to each farm. The standardised nature of the random samples taken at a farm is therefore paramount. For each farm that is screened, a calculation is carried out to determine the level of certainty with which it is possible to rule out the possibility of infection amongst the livestock. To that end, we rely upon an examination of individual animals as a diagnostic test for the farm as a whole. The sampling of milk stored in a tank, on the other hand, constitutes a mixed sample from all lactating cows on a particular farm. When testing a sample from milk stored in a tank, it is necessary to consider that only some of the cows on a farm may actually be lactating. For that reason, we analyse two samples taken at an interval of 3 months, in order that as many of the cows on a farm as possible are included.
In the case of IBR, we not only make use of selection at random, but also the risk-based selection of farms (see Section 8.1.2). Sentinel farms for the purpose of IBR testing feature several of the following characteristics, which were identified during an expert examination of the risk factors that apply in relation to IBR:

- Use of summer pasture
- Farms with an above-average rate of livestock movement (animal movements in the animal transport database)
- Farms that have imported cattle
- Proximity of farm to the border (a distance of 5 km between the farm and the border or road crossing the border)
- Farms in areas characterised by a high density of herds

These five risk factors give rise to a total of 32 permutations. Farms with the same combination of risk factors will have the same relative risk that the disease will occur. As a result, they will be assigned to the same risk group, of which there are 32 in total. Farms in groups 1–7 have a very high risk of the disease occurring on the farm. All farms in these uppermost risk groups are therefore selected as Sentinel farms. Farms belonging to the lower risk groups (number 8 or higher) are selected at random. The spot checks are also stratified by canton, based upon the number of farms in each canton. Stratification enables us to ensure that the farms that are selected are highly representative. In the case of the non-dairy farms selected at random, those that have been tested for IBR during the past three years are excluded.

Type of farm	Selection method	Data set	Random selection	Stratified by canton	Sampling period
Non-dairy cattle farms (blood samples)	Random selection	Animal Transport Database as at 11 November of preceding year	Yes	Yes	1.1. 2014.–31.5.2014
	Sentinel farms		No	No	
Dairy cattle farms (samples of milk from tanks)	Random selection	Milk testing, as at 11 November of preceding year	Yes	Yes	Two samples per farm: January and April 2014 (see Section 8.2.4)
	Sentinel farms		No	No	

Table 8.c: Selection of farms and sampling period

8.1.4 Selection of livestock

In the case of non-dairy farms, blood samples are primarily taken from cattle older than 24 months. These are then analysed to check for the presence of IBR antibodies. If fewer than seven animals are older than 24 months, a total of seven blood samples will be taken, including some from younger animals.
In the case of dairy farms, on the other hand, it is impossible to identify the cows that provided the milk that is included in a sample taken from a milk storage tank. By testing two samples taken at an interval of three months, there is a high probability that all of the lactating cows on a farm will have been included. All younger and male cattle are not included in the testing of milk contained in a storage tank.
In farms of both types, the probability of discovering any existing cow or bull infected with IBR will be 99%.

8.1.5 Laboratory analyses

As part of the IBR screening programme, samples of milk taken from storage tanks at dairy farms, or blood samples from individual animals from non-dairy farms are analysed. In the case of the samples of milk taken from storage tanks, diagnostic testing to ascertain the presence of IBR is carried out from what remains of the samples after the official milk testing has been carried out by Suisselab AG. The blood samples are extracted on the farms themselves by specially assigned veterinarians. They are then sent for testing to one of several laboratories accredited by the Federal Food Safety and Veterinary Office (FSVO) where they are individually analysed. The veterinarian must complete a collection report for each of the farms selected. If no blood samples could be taken - possibly because the farm no longer keeps cattle, or if, at the time that controls are being carried out, no cattle were present on the farm, the reason must be given. All samples taken as part of the sampling for IBR are also tested for EBL.
Irrespective of whether a milk or a blood sample is tested, the aim of the analysis will be ascertain the presence of any antibodies against BHV-1. Any type of laboratory-based diagnostic method can give rise to a false result, however this occurs only rarely and only under certain conditions. Those results may be either a false negative or a false positive. The probability of a laboratory-based test giving rise to a false-negative result is described by the concept of **sensitivity**. In the case of a false-negative result, an infected animal will not be identified as such. In the case of false-positive results, the concept of **specificity** will be applied. In the case of a false-positive result, a healthy animal will be incorrectly labelled as infected. When issuing evidence of disease-free status, the procedure adopted first involves carrying out a screening test, mostly in the form of an ELISA, which is as sensitive as possible. That way, no infected animal will be missed, though a few false-positive results may be generated. The positive samples identified following the ELISA test can then be re-examined using a specific test, in order to identify the false-positive samples. These confirmatory tests are carried out at the national reference laboratory.
This procedure can also be applied in the case of the blood samples taken in order to identify cases of IBR. In the case of the samples of milk, the procedure will require slight adaptation, as no confirmatory test is currently available in the case of milk samples being tested for IBR. What is more, the testing of milk sampled from a tank is highly sensitive and specific at the same time. For that reason and in the event that the testing of a milk sample taken from a tank gives rise to a positive result, the same ELISA test will be carried out once again. If the result of the second test to be carried out is also positive, all cattle from the farm will be tested by the taking of blood samples. If the second test to be carried out is negative, the sample will be tested for a third time and the result obtained on that occasion will be used (**Table 8.d**).

Animal disease and type of sample	Screening method	Sensitivity and specificity 1) [%]	Method used in confirmatory analyses of samples that have tested positive	Sensitivity and specificity [%]	Reference laboratory
IBR, blood samples	ELISA	99.3 and 98.3	Serum neutralisation test	Very good and 98.3–100	Virological Institute of the Vetsuisse Faculty of the University of Zurich
IBR, samples of milk taken from a storage tank	ELISA	Both almost 100	Blood samples at a farm	–	–

Table 8.d: Methods applied to screening for IBR, including sensitivity and specificity and the IBR reference laboratory

In view of the fact that before the samples taken at random are analysed, it is assumed that Switzerland is free of IBR, animal keepers from the farms tested can expect to receive a negative test result. In those cases, no laboratory reports are sent.

8.1.6 Case definition

The Animal Diseases Ordinance stipulates that in the case of IBR, any cow or bull confirmed by the reference laboratory to be carrying antibodies shall be deemed to be infected and that measures must be taken on the farm concerned (the same also applies in the case of EBL).
When evaluating cases in accordance with the Animal Diseases Ordinance, it is also necessary to distinguish between those cases in which antibodies were detected or those in which the presence of pathogens was established. In cases involving antibodies only, this means that the animal has been in contact with the pathogen at some time in the past. This may also mean that the animal was inoculated and is therefore incapable of infecting other animals. In very rare cases, it may also be the case that animals yield a positive result during the serological test, even though they had never been in contact with the pathogen in question. Animals of this type are referred to as **singleton reactors**. The reasons for this may involve non-specific immune responses or cross-reactive responses to other pathogens. As a result, different scenarios are capable of giving rise to a positive test result. It is therefore important to investigate the situation in more detail. Further investigations of the animal, the farm and any other farms with which the animal has been in contact are the only way to enable singleton reactors to be distinguished from a genuine outbreak of a disease, to find the route along which the disease arrived in the country and to adjust the measures in line with the actual level of risk that exists.

8.1.7 Results 2004–2014

Since 1994, the year in which tests of random samples were first used as a means of providing evidence for disease-free status, a number of individual IBR outbreaks have occurred. Following a major outbreak in a stable belonging to a cattle dealer in Graubünden in 2005 (**Table 8.e**), the most recent outbreak occurred in 2009 and involved three farms located in the Jura region. None of these outbreaks was identified during the random sampling programme (see Section 8.1.8). These particular cases highlight the existing risk of IBR being brought into Switzerland. In order that the analysis of samples taken at random does not only generate statistics used in order to provide evidence of disease-free status, but

is also represents a more suitable means of detecting outbreaks, we decided to forego risk-based random sample calculation from 2012 onwards. This meant, however, that the number of farms screened had to be increased. What is more, the use of diagnostic testing of milk sampled from storage tanks enabled the number of farms being tested to be increased, in a cost-neutral manner. It was also necessary to forego the risk-based random sample calculation in 2010 and 2011. This was due to the outbreak of IBR in 2009. In addition, two samples tested positive in 2010. During that period, it was not possible to provide evidence of disease-free status, nor was it possible to arrive at a reliable estimation of the situation with regard to disease status.
With the exception of 2005, it has always been possible to arrive at the required degree of certainty. Since 2011, the degree of certainty has even been significantly higher than the required level of 99%. The fact that the surveillance that has been carried out since 2011 is also more suitable when it comes to detecting any outbreak that may already have occurred, is evidenced by the larger number of farms (which, in turn, provides more effective coverage of the population due to the use of the random sample) and by the singleton reactors discovered in 2013 and 2014. In 2014, a total of 62 Sentinel farms were tested by the taking of blood samples, while 58 Sentinel farms were tested using samples of milk taken from storage tanks, 1,218 farms selected at random were tested through the taking of blood samples and 1,665 farms selected at random were tested using samples of milk taken from storage tanks. Overall, a total of 20,284 blood samples and 3,372 samples of milk taken from storage tanks were analysed. The rise in the number of samples testing positive during the screening was most likely due to the increase in infections with a different herpes virus, namely the pathogen associated with bovine mammillitis (BHV-2). In 2015, a research project was carried out into that condition.

Year	Number of farms tested	Number of samples tested	Screening of samples that tested positive	Confirmations of samples that tested positive	Certainty of disease-free status obtained [%]
2014	3,003	24,656	101	1	over 99.99
2013	2,961	19,460	90	1	over 99.99
2012	2,836	22,010	53	0	99.70
2011	2,115	48,996	55	0	99.80
2010	2,303	46,804	69	2	99.10
2009	1,410	27,732	13	0	99.70
2008	1389	28,488	23	0	99.40
2007	1,391	26,144	5	1	99.60
2006	1,471	29,151	–	0	99.00
2005	1,430	28,241	271	1	97.20*
2004	2,828	26,364	–	0	99.00

Table 8.e: Results of the random sampling carried out since 2004 in order to detect cases of IBR
* Production of evidence of disease-free status unsuccessful. The case identified in the random sample was a singleton reactor. Irrespective of this particular case from the random sample, screening carried out upon animals being transported identified a further animal that was sero-positive.

8.1.8 More detailed epidemiological investigation arising from surveillance activity

The types of epidemiological investigation that are required in response to each occurrence of an animal disease are laid down in the Animal Diseases Ordinance. This chapter will now set out to describe investigations that extend beyond such activities. If a case of IBR is detected, the farm concerned will be placed in quarantine, until such time as the infected cattle have been slaughtered and the remaining cattle have been retested after 30 days and the results of those tests have been found to be negative. All epidemiologically linked will also be tested. Epidemiologically linked farms are those farms from which the infected farm has received cattle, with whose cattle the infected cattle from the farm concerned have been in contact or to which cattle from the infected farm were moved. Precisely which farms are epidemiologically linked will be established in accordance with the risk assessment carried out by the cantons and the Federal Food Safety and Veterinary Office (FSVO).

2011

The IBR outbreak in 2009 that was mentioned in Section 8.1.7 involved 2 farms in the canton of Jura and a third farm in the canton of Neuchâtel, in which only a calf purchased from outside the farm tested positive for IBR. In 2010, during the random sampling carried out in order to provide evidence of disease-free status in connection with IBR, 2 animals in the canton of Jura were found to be sero-positive. An analysis of animal transport data uncovered a contact network involving around 100 farms, many of which were located in the canton of Jura. For that reason, it was decided to carry out a full investigation in to these cases and to screen additional farms in Jura for IBR. In 2011, the farms to be screened were selected on the basis of three criteria:

- All farms that formed part of the contact network referred to above
- In the district of Porrentruy, all farms displaying at least two of the six risk factors.
- In the canton of Jura, all farms that had sent cattle to summer pasture in France in 2009 and 2010

Thereafter, an additional 188 farms were screened for IBR. All of those farms tested negative.
An evaluation of the contact network was carried out, in order to calculate the risk that the disease may have been transmitted between the farms concerned. This is possible, on condition that one of the two affected farms in the canton of Jura in 2009 was the primary case and that the disease was transmitted from that farm to the other farm affected. Of the farms within the contact network during 2009/2010, only one was found to be IBR-positive. According to an analysis of the animal transport database, each of the affected farms had contact with around 100 other farms in Switzerland during that period. For the period in question, this equates to a risk of transmission of 2% and can therefore be regarded as minimal.
The evaluation of the farms tested with the aim of providing evidence of disease-free status for the district of Porrentruy and the canton of Jura, meant that it was possible to acquire additional information during the course of the investigations. By carrying out an evaluation, it is also possible to estimate the probability of an independent occurrence of IBR and to relate this to the validity of the national random sampling programme. In order to calculate the probability of an occurrence of IBR, the total number of cattle farms in Porrentruy that were listed in the animal transport database (TVD 2010) was determined to be 315, whilst the number in the canton of Jura that were listed in the agricultural information system (AGIS 2009) was found to be 950 (**Table 8.f**). The relative risk for the at-risk farms was determined to be factor 3.

	Companies	Farms tested (at-risk farms)	With 99% certainty, fewer than … infected farms	With 95% certainty, fewer than … infected farms
Porrentruy	315	35	11	8
Jura	950	135 at-risk farms, plus 14 selected at random	9	5

Table 8.f: Result of the additional investigations in the canton of Jura in 2011

In contrast, the national random sampling programme carried out across Switzerland as a whole provided evidence that to a level of certainty of 99%, the herd prevalence was below 0.2%. This corresponds to around 90 infected farms. This regional evaluation therefore clearly demonstrated that a larger outbreak of IBR in the canton of Jura can be ruled out. What is more, having carried out this investigation, the certainty that the canton of Jura is disease-free is greater than the level of certainty that applies to the rest of Switzerland.
For statistical reasons, it is impossible to provide absolute proof of disease-free status using random sampling. Rather, this method is capable of providing information regarding the probability (certainty) that the prevalence will lie below a specific value. The outcome of this procedure depends to a considerable degree upon the size of the population that is tested: the smaller the population tested, the lower the degree of certainty that the prevalence will lie below the specified value. To that extent, it comes as no surprise that a small number of infected farms in the canton of Jura cannot be ruled out. This does not mean, however, that these actually exist. Due to the fact that a cluster of cases within the same region can be expected when an outbreak of an infectious disease occurs, the degree of certainty obtained as a result of a regional screening is greater than the certainty that would be obtained from a screening programme on a national level involving the same number of farms. In addition, the results must always be viewed in the context of the additional surveillance measures. These also gave no indication of an outbreak of disease in the canton of Jura.

2009

IBR was detected during the examination of an aborted foetus in the canton of Jura. The outbreak encompassed two farms located in that canton. On a third farm located in the canton of Neuchâtel, IBR was only detected in a calf purchased from outside of the farm. In two of the three farms examined, a large proportion of cattle were sero-positive. In order to combat IBR, those cattle had to be slaughtered. What this outbreak shows is that IBR occurred in Switzerland in 2009. Despite successful random sampling, it was therefore impossible to assume that cattle from Switzerland were free of IBR. For that reason, no residual certainty could be assumed during the programme of random sampling carried out in 2010. As a result, it was necessary to carry out a random sample calculated in the conventional way in 2010. This meant that in 2010, it was necessary to double the number of farms screened, in comparison to 2009.

2007

The animal that tested positive was actually a 14-year old cow imported from France in 1999. The farm had been screened in 2006 during random sampling and according to the documentary records, the cow that tested positive in 2007 hadtested serologically negative in 2006. At the time that the random sampling was carried out in 2007, the cow that tested positive was lactating, was treated for mastitis and displayed none of the clinical symptoms of IBR or IPV. During the investigations on the farm, it was determined, however, that the random sampling in 2006 and 2007 was not carried out correctly; too few samples had been taken. In 2006, an additional 36 cattle and in 2007, 37 cattle tested serologically negative. During the screening 30 days after the cow that tested positive was slaughtered, all 99 cattle on the farm tested serologically negative. Investigations on the epidemiologically linked farms revealed

no signs of IBR or IPV. Overall, the case was categorised as an isolated positive case, though an infection with BHV-1 cannot be ruled out with absolute certainty. Nevertheless, more plausible explanations are available for the facts established. The ultimate reason for the laboratory results will have been a non-specific response or, more likely, a latent infection that was reactivated, or a living virus administered in the form of a vaccination that was originally latent but became reactivated. In particular, references are made in the literature to laboratory results obtained in animals infected with BHV-1 and then vaccinated with an IBR marker, that were unable to be replicated. This situation could have occurred in the case of the animal that tested positive in 2007, that is, it could have been vaccinated prior to being imported into Switzerland.

2005

In the canton of Appenzell Innerrhoden, a cow from a cattle farm was diagnosed with IBR/IPV. The cow, along with an additional animal suspected to be infected, was slaughtered immediately and the farm was put into quarantine by the animal health authorities. The cow that tested IBR-positive had been born and reared at the farm concerned and was clinically healthy at the time the samples were taken. No further cases were discovered during investigations carried out at the epidemiologically linked farms. All of the measures required under the Animal Diseases Ordinance were carried out. No signs of an outbreak of disease were found. This was therefore a case of a singleton reactor.
A second case was diagnosed in the canton of Aargau. A cow had been admitted to an animal hospital as a result of a different disease and tested positive in the screening, as well as in the confirmatory test. Following investigations on the epidemiologically linked farms and in all farms that had sent cattle to the animal hospital during the same period, no further animals were found to be carrying the infection. All of the measures required under the Animal Diseases Ordinance were carried out. As there no signs were found that pointed to an outbreak of disease, this case was also deemed to be singleton reactor.

8.1.9 Conclusion

Switzerland also successfully provided evidence of disease-free status for IBR in 2014. As in the preceding years, the level of certainty obtained during the programme of random sampling was significantly higher than the level required by the EU. This is a manifestation of the significant improvement in surveillance made during the screening programme since 2009, which was achieved without giving rise to an increase in costs. In view of the risk of disease being brought into the country, that improvement in surveillance is justified, as it enables an outbreak of IBR to be detected as early as possible, so that the cost of combating the disease can be kept manageable.

8.2 Enzootic bovine leukosis

Enzootic bovine leukosis (EBL) is a chronic, wasting disease that primarily occurs in cattle. Goats and sheep are affected only rarely. The disease is not harmful to humans. The disease is caused by the bovine leukaemia virus of the deltaretrovirus genus (the Retroviridae family).
After infection, it takes from months to years until symptoms of the disease become visible. The clinical form of the disease typically begins with a loss of appetite, deterioration in milk output and weight-loss. After that, the victim's lymph nodes become enlarged (lymphadenopathy). Depending on their location, these expanding lymph nodes may not cause any symptoms, or may give rise to typical symptoms. If the affected lymph nodes are located near the surface, they will be easily visible. In an animal sent for slaughter, changes to the lymph nodes can easily be confused with tuberculosis. Only cattle which have a genetic pre-disposition will develop this illness. Other cattle may lack any signs of the disease, though the typical changes associated with leukosis may well be detectable in their blood. The infection can be determined by the presence of non-neutralising antibodies. As no neutralising antibodies are formed in

the case of leukosis, the disease cannot be diagnosed by means of a serum neutralisation test (SNT). The disease is transmitted via milk, semen, blood, contaminated equipment (used syringes, dehorning tools) and by biting houseflies (gadflies). Though nowadays, only individual animals belonging to an affected herd are actually clinically affected by a disease, EBL formerly gave rise to significant commercial losses. Today, EBL is widespread, but has been eradicated in many European countries.
Switzerland has carried out a screening programme since 1994, as a means of providing evidence of its disease-free status in connection with EBL. After 9 years with no cases of EBL or any isolated positive cases, the most recent case of EBL in Switzerland occurred in 2005. This involved a serological singleton reactor.
The surrounding regions and countries are predominantly free of EBL. In the case of imports from regions that are not EBL-free, cattle must undergo a special quarantine programme. Trade between EBL-free regions is not subject to regulation.

8.2.1 Procedure to provide evidence of disease-free status

In order to provide evidence of disease-free status in connection with EBL, the following conditions must have been fulfilled in advance (this is explained in Section 8.1.1):

- No signs of EBL
- Compulsory reporting of disease and any suspected cases
- Disease-awareness and effective early detection

In view of the fact that in the case of EBL, the clinical manifestation of the disease occurs only in a small number of infected cattle and only following a long period of incubation, clinical surveillance is not a very promising method of detecting infected animals at an early stage. During the incubation period, transmission of the infection to other cattle is possible, but occurs only rarely. With regard to the surveillance of entire farms, this fact means that an infected animal can form part of a herd for several years, without other animals becoming infected. With regard to the surveillance of EBL, an important aspect of the monitoring process is for the meat control personnel to examine the lymph nodes of an animal for typical changes at the point of slaughter.
As a result of Switzerland's bilateral treaties with the EU, it is sensible to carry out random sampling as part of a screening programme, in order to provide evidence of disease-free status in relation to EBL and in order to be able to export cattle and products derived from cattle to other countries that are also EBL-free. The importation of cattle and semen can also be regulated. The screening programme implemented in Switzerland fulfils the requirement by the EU that disease-free status be underpinned by relevant statistical evidence.

8.2.2 Calculation of the random sample

In the case of random sampling to test for EBL and IBR, the same farms are selected and all cattle sampled are screened for both diseases. The calculations that form the basis of the random sample are the same for IBR as they are for EBL (see Section 8.1.2). In accordance with the bilateral treaties concluded with the EU, disease-free status in connection with EBL must be evidenced by means of a herd prevalence of below 0.2% that has been established to a certainty of 99%.

8.2.3 Selection of farms

Random sampling to establish the presence of EBL is carried out on the same farms as those selected for screening for IBR. The methods used when selecting those farms were described above in connection with IBR (see Sections 8.1.2 and 8.1.3). During a separate expert survey, three risk factors for EBL were identified that are used in order to select Sentinel farms:

- Use of summer pasture
- Farms with an above-average rate of livestock movement (with reference to the animal transport database)
- Farms that have imported cattle

These three risk factors give rise to a total of eight different permutations. Farms with the same permutation of these factors will have the same relative risk of EBL occurring on the farm. Those farms belong to the same risk group and the number of possible permutations dictates that the number of risk groups totals eight. Farms belonging to groups 1 and 2 have the highest relative risk. All of these are treated as Sentinel farms. Farms belonging to group 3 that have a lower risk need not be included without exception and are therefore selected at random.

8.2.4 Selection of livestock

For the purpose of these investigations into the possible occurrence of EBL, samples from the same cattle are used as were used during screening for IBR (see Section 8.1.3 and 8.1.4).

8.2.5 Laboratory analyses

As each sample from the IBR screening programme is also analysed to detect EBL, significant aspects of the laboratory analysis were described in relation to IBR (see Section 8.1.5). They apply in equal measure to EBL, with the exception of the information regarding sensitivity and specificity of the screening and confirmatory analysis and the reference laboratory indicated (**Table 8.g**).

Animal disease and type of sample	**Screening method**	**Sensitivity and specificity 1) [%]**	**Method used in confirmatory analyses of samples that have tested positive**	**Sensitivity and specificity [%]**	**Reference laboratory**
EBL, blood samples	ELISA	Almost 100 and 99.8	ELISA-Ab GP-51	Almost 100 and 99.5	Institute of Virology and Immunology (IVI) of the Vetsuisse Faculty at the University of Bern
EBL, samples of milk taken from storage tank	ELISA	Both almost 100	Blood samples at a farm	–	–

Table 8.g: Methods applied to screening for EBL, including sensitivity and specificity and the EBL reference laboratory

8.2.6 Case definition

Cases of EBL are defined in the same way as cases of IBR (see Section 8.1.6). In the case of EBL, singleton reactors (cross-reactive responses) occur even more rarely, however, than in the case of IBR.

8.2.7 Results 2004–2014

Since 2004, when analyses of random samples were carried out for the first time, only individual cattle have tested positive for EBL. It is almost impossible to say whether these were singleton reactors or were infected animals, which up to that point had not infected any other animals. Nevertheless, we can certainly assume that EBL does not occur endemically in Switzerland without having been detected. This has been clearly established by the analyses of random samples that have been carried out over a number of years.

With the exception of 2005, it was always possible to arrive at the required level of certainty. Since 2011, the level of certainty has even been significantly higher than the required level of 99%. In 2014, a total of 305 Sentinel farms were tested by the taking of blood samples, while 311 Sentinel farms were tested using samples of milk taken from storage tanks, 975 farms selected at random were tested through the taking of blood samples and 1,414 farms selected at random were tested for EBL using samples of milk taken from storage tanks (total: 3005 farms, **Table 8.h**). Overall, a total of 20,284 blood samples and 3,412 samples of milk taken from storage tanks were analysed (23,696 samples in total).

Year	Number of farms tested	Number of samples tested	Screening of samples that tested positive	Confirmations of samples that tested positive	Certainty of disease-free status obtained [%]
2014	3,005	23,696	13	0	over 99.99
2013	2,961	20,498	21	0	over 99.99
2012	2,836	22,026	16	0	99.70
2011	1,310	29,751	4	0	99.80
2010	1,363	27,702	1	0	99.10
2009	1,410	27,732	6	0	99.70
2008	1389	28,488	1	0	99.40
2007	1,391	26,144	2	0	99.60
2006	1,471	29,151	1	1	99.00
2005	1,430	28,241	83	1	96.90*
2004	919	15,516	–	0	99.00

Table 8.h: Results of the random sampling carried out since 2004 in order to detect cases of EBL
* Production of evidence of disease-free status unsuccessful. The case identified within the random sample was a singleton reactor. Irrespective of this particular case from the random sample, screening carried out upon animals being transported identified a further animal that was sero-positive.

8.2.8 More detailed epidemiological investigations arising from surveillance activity

The types of epidemiological investigation that are required in response to each occurrence of an animal disease are laid down in the Animal Diseases Ordinance. The measures to be taken in the event of an occurrence of EBL are similar to the ones to be taken in an occurrence of IBR (see Section 8.1.8), but are slightly more stringent. For example,the milk must be boiled before being used to feed animals and two serological tests of the farm must be carried out following the slaughter of the infected animals. The additional tests required are described below.

2005

In the canton of Zurich, a five-year-old cow from a cattle farm was diagnosed with EBL. The cow was slaughtered immediately and the farm was put into quarantine by the animal health authorities. The cow which tested positive for EBL had been healthy at the time that the sample was taken. During an examination of the lymph nodes after slaughter, no bovine leukosis virus was found. No further cases were discovered during investigations carried out at epidemiologically linked farms. All of the measures required under the Animal Diseases Ordinance were carried out. No signs of an outbreak of disease were found. This therefore concerned a singletone reactor.

8.2.9 Conclusion

Switzerland also successfully provided evidence of disease-free status for EBL in 2014. As in the preceding years, the level of certainty obtained during the programme of random sampling was significantly higher than the level required by the EU. This is a manifestation of the significant improvement in surveillance carried out during the screening programme since 2009, which was achieved without giving rise to an increase in costs.

8.3 Porcine reproductive and respiratory syndrome

Porcine reproductive and respiratory syndrome (PRRS) is caused by the PRRS virus, which is part of the genus *Arterivirus*. Depending on the location of the first occurrence, it is possible to distinguish between North American and European strains. Today, both strains occur the world over. The virus only affects pigs and does not remain contagious for long in the environment. The incubation period is short, lasting only a few days. As its name suggests, the disease occurs in two forms. The reproductive form primarily affects breeding sows and boars. Breeding sows display symptoms of fertility disorder and late abortions, whilst in the case of boars, their fertility is reduced. Older piglets show symptoms of stunted growth, fever and loss of appetite. In its respiratory form, the disease affects the respiratory tract in older piglets and fattening pigs. They have fever, sneeze, cough and have difficulty breathing. This, in turn, affects their development as fattening pigs. As a result of these clinical symptoms, PRRS forms an important differential diagnosis in relation to Classical and African swine fever. In most cases, all of the pigs on an affected farm will contract the disease. The death rate, however, remains low. Transmission within the herd occurs via direct contact or through the air. In rarer cases, it may occur as a result of feeding the animals with uncooked meat waste or using infected semen. In the case of transmission from farm to farm, this can occur as a result of animal movement or through the air across a distance of a few hundred metres. Vaccinations against PRRS are available, though the vaccination only goes some way towards minimising losses, but does not restrict the spread of the virus itself. In addition, the viruses used in the vaccination can themselves be transmitted and can cause large-scale losses in farms whose livestock have not been vaccinated.
PRRS occurs in almost all countries in Europe. All of Switzerland's neighbouring countries are infected and Switzerland itself is one of the few countries in the world that are free of PRRS. Up to the present

time, the disease has been diagnosed in Switzerland only three times, before being eradicated immediately afterwards. The most recent outbreak in Switzerland was in 2012. In 2006, the official programme of screening using random sampling of pigs was expanded with the addition of the random sampling required in order to provide evidence of disease-free status, in accordance with which it became possible to demonstrate that Switzerland is PRRS-free. No international agreements exist with regard to PRRS. The screening programme is carried out in order to confirm Switzerland's status as a PRRS-free country. The importation of the disease and its subsequent onward transmission throughout the entire territory of Switzerland could result in severe economic consequences.

8.3.1 Procedure for the monitoring of disease-free status

In order to provide evidence of disease-free status in connection with PRRS, the following conditions must have been fulfilled in advance (this is explained in Section 8.1.1):

- No indications of PRRS in Switzerland
- Compulsory reporting of disease and any suspected cases

Switzerland's status as a country that is free of PRRS was first demonstrated back in 2001. At that time, following a minor outbreak, a mass screening was carried out, in which over 40,000 pigs were serologically tested for PRRS. The outcome confirmed the fact that at that time, having successfully combated the outbreak, Switzerland was free of PRRS once again. There is always a risk that PRRS will be brought back into the country. That is why it is crucially important to have detailed disease-awareness and an effective means of recognising disease at an early stage. Animals that are displaying the typical, clinical signs of a disease must be tested. This means, for example, that the breeding sows in a herd that are affected by a noticeably increased rate of abortion must be screened for PRRS. Though the signs will generally be thought to be the result of a different cause, due to the fact that PRRS is not endemic in Switzerland, such screening is still necessary, as the disease may be brought in from outside the country at any time. Other than in the case of diseases that are subject to international regulations, no import regulations have been introduced in the case of PRRS. Nevertheless, import organisations voluntarily adhere to a number of stringent rules. Furthermore, all pigs that are tested because they are suspected to be suffering from swine fever or that are examined during screenings for that diseases, are also screened for PRRS.
The PRRS screening programme is the same as the one carried out in order to screen for Aujeszky's disease. This enables synergies to be utilised in the most effective possible way. This also ensures that the PRRS screening programme is underpinned by the necessary scientific and statistical data.

8.3.2 Calculation of the random sample

The screening programme for PRRS is largely based on the screening programme for Aujeszky's disease. The reason for this is that Switzerland carries out the PRRS screening for its own interests and the EU imposes no requirements in that regard. For that reason, the risk-based random sample calculation is also applied in the case of PRRS (this is explained in Section 8.1.2). A random sample must provide evidence of a herd prevalence below 0.2%, to a level of certainty of 99%. All other aspects of the random sample calculation are described in the section referring to Aujeszky's disease (see Section 8.4.2).
An obvious disadvantage of the smaller sample achieved by means of a risk-based random sample calculation, lies in the fact that it would cause the probability that infected farms would be found, if they existed, to be reduced. In view of the favourable international situation with regard to the disease, this disadvantage can be tolerated in the case of Aujeszky's disease; however this is not also true of PRRS, as there a risk that it may be brought into the country. During the past few years, a number of cases, in which PRRS was brought into the country, resulting in an outbreak, were discovered in Switzerland and some of these were discovered during the screening programme. In order to increase the probability

that any infected farms will be identified by means of the screening programme, the sensitivity of the screening programme should be increased from 2015 onwards, such that breeding farms are also included in the screening programme.

8.3.3 Selection of farms

As the PRRS screening programme is dependent upon the screening programme for Aujeszky's disease, the selection of farms for the purpose of the PRRS screening takes place in the manner that is described in the case of Aujeszky's disease (see Section 8.4.3). All samples are tested for both diseases.

8.3.4 Selection of livestock

The PRRS screening programme is based upon the screening programme for Aujeszky's disease. For that reason, the livestock are selected and samples taken in the same manner that is described in the case of Aujeszky's disease (see Section 8.4.4). All samples are tested for both diseases.

8.3.5 Laboratory analyses

All blood samples from the screening programme for Aujeszky's disease are also tested for antibodies against PRRS. The procedure that is followed is described in the section referring to Aujeszky's disease (see Section 8.4.5). The methods used in the screening and the confirmatory analysis for PRRS, the sensitivity and specificity that apply in each case and details of the reference laboratory for PRRS are given here (**Table 8.i**).

Animal disease and type of sample	**Screening method**	**Sensitivity and specificity 1) [%]**	**Method used in confirmatory analyses of samples that have tested positive**	**Sensitivity and specificity [%]**	**Reference laboratory**
PRRS, blood samples	ELISA	94 and 99.1	Indirect fluorescence test (IFA)	96 and 98.7	Institute of Virology and Immunology (IVI), Mittelhäusern

Table 8.i: Methods applied to screening for PRRS, including sensitivity and/or specificity and the PRRS reference laboratory

8.3.6 Case definition

The Animal Diseases Ordinance stipulates that an occurrence of PRRS requires two pigs on a given farm to have been confirmed by an reference laboratory to be carrying antibodies against PRRS. This special definition is necessary as a result of the comparatively low specificity of a PRRS diagnosis (see Section 8.3.5). If, on the other hand, the presence of the virus is established, then a single pig is sufficient to constitute an occurrence of the disease. If, of the six pigs per farm from which samples are taken, only one pig is confirmed to be sero-positive, further samples must then be taken from this farm of origin and analysed. Based upon the results obtained from those samples, a decision is then taken as to whether this constitutes an occurrence of the disease, or not.
Nevertheless, different scenarios are capable of giving rise to a positive test result (see Section 8.1.6).

For that reason, it is important to investigate the situation in more detail and to distinguish isolated positive cases from a genuine outbreak of the disease. As antibodies against the PRRS virus are only detectable for a few months, a rapid investigation is crucial in order to estimate the actual cause of a positive finding of PRRS.

8.3.7 Results 2004–2014

Since 2006, random samples have been taken from pigs at the slaughterhouse and are tested for Aujeszky's disease and PRRS.
Up to 2012, the results obtained in the case of PRRS were unequivocally negative. There were also no signs of the disease outside the scope of the screening programme. In 2012, it became known that the disease had been brought into the country in semen imported from Germany. While monitoring a breeding boar farm in Germany, an infection with PRRS was detected and the Swiss authorities were informed. The necessary investigations in Switzerland encompassed tests of 9,500 pigs on more than 100 farms. The PRRS virus was found in three farms (**Table 8.j**), and on one farm, the virus had spread further. All animals from that herd had to be slaughtered. The random sample in 2013 was negative without exception. In 2014, three sero-positive pigs were detected amongst the samples and investigations revealed that a breeding farm was infected. From there, the virus had also been transmitted to a fattening farm. In the case of another occurrence of the disease, a number of sero-positive pigs were found, but the virus itself could not be detected. Based on these findings, it is difficult to gauge the situation regarding PRRS in Switzerland. The most probable explanation for the situations observed is that they can be attributed to vaccinations of individual pigs after the disease was brought into the country from Germany in 2012. There is, however, no evidence to back up this explanation.

Year	Number of farms tested	Number of samples tested	Screening of samples that tested positive	Confirmations of samples that tested positive	Certainty of disease-free status obtained [%]
2014	1,254, of which 1,252 with six or more blood samples	8,238	32	3	over 98.98*
2013	1,267	8,305	86	0	over 99.01
2012	1,294	8,747	15	0	99.03
2011	4,258	8,897	8	0	99.00
2010	1,237	8,677	14	0	99.10
2009	1,268	9,349	39	0	99.10
2008	1,322	9,296	10	0	99.10
2007	1,202	8,454	1	1	99.00
2006	1,364	9,590		0	99.20
2005	1,430	28,241	271	1	97.20*
2004	2,828	26,364	–	0	99.00

Table 8.j: Results of the random samples taken since 2004 in order to detect cases of PRRS
* Evidence of disease-free status successful, despite positive test findings. In accordance with the case definition for PRRS, occurrence case is only deemed to exist if two pigs on a farm are found to be sero-positive. Seropositive samples were found within the random sample, however, though these only related to individual animals on each the fattening farms concerned. The three occurrences of the disease were then detected during the investigations.

8.3.8 More detailed epidemiological investigations arising from monitoring activity

The types of epidemiological investigation that are required in response to each occurrence of an animal disease are laid down in the Animal Diseases Ordinance. This chapter will set out to describe investigations that extend beyond such activities. If a case of PRRS is detected, the farm concerned will be placed in quarantine, the infected pigs are slaughtered and the remaining pigs retested after 30 days. In order for the quarantine to be lifted, the test results obtained at this point must be negative. All epidemiologically linked farms are also tested. Epidemiologcially linked farms are those farms from which the infected farm has received pigs, farms whose pigs have been in contact with pigs from the infected farm, or farms, to which pigs from the infected farm have been moved. Precisely which farms are epidemiologically linked is established in accordance with the risk assessment carried out by the cantons and the Federal Food Safety and Veterinary Office (FSVO).

2014

In spring 2014, the PRRS virus was found to be present on one breeding farm and one fattening farm. What is more, it was also impossible to rule out with sufficient certainty that the virus had been transmitted on an individual basis within other pig farms. For that reason, additional screening of pig breeding farms was ordered. From mid-August to early September 2014, tests of breeding sows were carried out at 107 breeding farms and in a random selection of a further 99 pig breeding farms. Those tests have since been completed and show that in the 3,281 pigs tested in total, no further incidences of the PRRS virus were found. During the initial screening, 12 animals tested positive for antibodies against the virus. Of those animals, 11 were found to be negative in the confirmatory test. Only one animal was still found to be positive in the confirmatory test. It was not possible, however, for an epidemiological link with a possible PRRS infection to be demonstrated. Thanks to intensive follow-up investigations at the pig breeding farms, it proved possible for Switzerland's continued favourable status with regard to PRRS to be confirmed.

2012

In late November 2012, the PRRS virus entered Switzerland as a result of the importation of sperm originating from infected animals at a breeding boar facility in Germany. A PRRS infection was detected on three farms in Eastern Switzerland. Those farms were placed in quarantine and investigations carried out within the herds. At one farm, the infection had already spread and so the entire herd had to be culled. A further 23 breeding farms were placed in quarantine, as they had also used sperm from the aforementioned breeding boar facility in Germany. Epidemiologically linked farms that had received animals from those breeding farms were also placed in quarantine. The blood samples taken from these farms (over 9,500 in total) were found to be PRRS-negative, however.

8.3.9 Conclusion

Switzerland also successfully provided evidence of disease-free status for PRRS in 2014. This was still possible despite the occurrences of the disease that were identified, as those occurrences were promptly and rigorously dealt with and ultimately turned out to be isolated cases. Nevertheless, the situation remains unclear, as neither the route along which the virus entered the country, nor the cause of the positive serological findings, could be traced. Nevertheless, all of the facts do not point to an outbreak of PRRS in Switzerland in 2014, but to individual, non-linked events without any major transmission of the virus.

8.4 Aujeszky's disease

Aujeszky's disease is caused by the *Suid Herpesvirus 1* (SuHV1). Only pigs secrete the virus, once infected. Human beings are not susceptible to the virus. As far as this particular virus is concerned, it is necessary to make a distinction between the primary host (the pig) and the final host (other susceptible animal species). The primary host is the species in which the virus regularly occurs, from which other species become infected. Final hosts do not, however, transmit the virus themselves. They can however become ill or die as a result of being infected with the virus. An infection with the SuHV1 virus is fatal in almost all mammalian species. Only in primates and horses does the disease rarely lead to a fatal outcome. As is the case with all Herpes infections, pigs infected with SuHV1 will remain carriers of the virus for the rest of their lives. The secretion of the virus is reactivated as a result of stress. A typical feature of outbreaks on pig farms is that dead rodents, dogs and cats are also found. The transmission of the virus to end hosts mostly occurs via uncooked meat or abattoir waste. Between pigs themselves, there are a number of routes of transmission - by direct contact with infected animals, via infected semen or secretions, airborne transmission, vertical transmission from sow to piglet, or indirect transmission via contaminated feed or contaminated objects. End hosts become ill only a few days after infection, contracting encephalomyelitis (inflammation of the brain and linings of the brain and the spinal cord). They also experience extreme itchiness. The resulting changes in behaviour resemble those associated with rabies. For that reason, Aujeszky's disease is sometimes referred to as pseudo-rabies. The clinical symptoms in infected pigs are less clearly defined. Depending on the age of the pig at the time of infection, the central nervous system, the respiratory system or reproductive system may be affected. Fully-grown pigs do not normally become ill following infection.
Alongside Switzerland and Denmark, Sweden, Finland, Norway, Luxembourg, Austria, Germany and the United Kingdom (except for Northern Ireland), together with parts of France, have been recognised as being free of Aujeszky's disease in domestic pigs. In Switzerland, the most recent recorded outbreak in domestic pigs occurred in 1990. Aujeszky's disease probably continues to occur at very low levels amongst wild pigs and therefore does not pose any threat to other animal species. Hunting dogs in particular are at risk of contracting the disease if waste or parts of wild pigs are fed to them. The SuHV1 viruses occurring in wild pigs pose hardly any risk at all to domestic pigs, as the viruses have become specially adapted to wild pigs.

8.4.1 Procedure for the monitoring of disease-free status

In order to provide evidence of disease-free status in connection with Aujeszky's disease, the following conditions must have been fulfilled in advance (this is explained in Section 8.1.1):

- No indications of PRRS in Switzerland
- Compulsory reporting of disease and any suspected cases

Random sampling in order to detect Aujeszky's disease has been carried out since 2001. As Switzerland's neighbouring countries are also free of Aujeszky's disease and Switzerland does not import any live breeding pigs, there is only a minimal risk that the virus will be brought into the country. As a result of the bilateral treaties with the EU, it is a sensible precaution to carry out a screening programme for Aujeszky's disease by means of random sampling. The screening programme is necessary, in order to be able to export live pigs and products derived from them to countries that also hold disease-free status. Furthermore, this also enables the importation of live pigs and their semen to be regulated. An important pre-condition for such trade relationships is the comparability of disease-free status in the various countries involved, in other words, the statements on which disease-free status is based must be backed up in the form of relevant statistics. The screening programme operated in Switzerland fulfils that requirement.
The screening programme for Aujeszky's disease was also adopted in order to screen for PRRS (See Section 8.3.1). The synergies that exist between the two programmes are being used as effectively as possible.

8.4.2 Calculation of the random sample

The sample is selected at random, in accordance with statistical principles. Only if the farms to be sampled are selected at random is it possible to extrapolate the results across the population as a whole. In order to carry out the sampling in the most effective possible way, the Federal Food Safety and Veterinary Office (FSVO) has developed additional methods and has refined them (see Section 8.1.2). In the case of Aujeszky's disease, a risk-based random sample calculation is used. The reason for this is that the risk of Aujeszky's disease being brought into the country is very small and that since the introduction of random sampling, no further outbreaks have occurred in Switzerland. The reduced quality of surveillance provided by the sampling associated with this procedure is not of concern in the case of this particular disease and it is therefore possible to utilise the economic benefits generated by this procedure. In the case of Aujeszky's disease, bilateral treaties stipulate that random sampling must be carried out that demonstrates with 99% certainty that the herd prevalence is lower than 0.2%.
The screening programme in 2014 focused solely upon fattening farms, as samples can easily be taken from fattening pigs at the point of slaughter. Furthermore, the size of the slaughterhouses means that it is possible to examine a sufficient number of animals from a particular farm, in order to be able to arrive at a statement regarding the farm concerned. As fattening pigs originally come from breeding farms, this is also a means of monitoring those farms as well, albeit indirectly. From an organisational point of view, samples taken to test for Aujeszky's disease and PRRS are processed at the same time.
To evaluate the samples, we apply the Bayesian method (see Section 8.1.2). As Switzerland has not imported any breeding pigs for many years, it is not possible to carry out a quantitative import risk assessment in the case of Aujeszky's disease. For that reason, we make use of a simplified process, within which a reduction in certainty of 10% per year is taken into account in the calculations. That 10% is based upon a "management" decision and is intended to take account of all conceivable import risks. The reduction in certainty of 10% corresponds to a halving of the certainty, in other words, the sample is around half the size than it would have been, had this calculation process not been used.

8.4.3 Selection of farms

In order to carry out screenings for Aujeszky's disease and PRRS, farms are selected by means of convenience sampling by the meat control personnel at 4 slaughterhouses. Meat control personnel determine of their own accord, from which farms and from which animals the samples will be taken. The Federal Food Safety and Veterinary Office (FSVO) determines only the period and the number of farms from which samples must be taken at each slaughterhouse. The multiple testing of farms should be avoided, but can sometimes occur, as the slaughterhouses do not have access to a database of their own.
As we have determined during the past few years that from certain cantons almost no pigs for slaughter are sent to the four abattoirs, samples are taken at the farm by veterinarianss at three farms in the Principality of Liechtenstein and in the cantons of Valais, Ticino and Glarus. In those cases, a total of six blood samples are taken from each of the pig farms from pigs that are older than six months.

8.4.4 Selection of livestock

The meat control personnel at the slaughterhouse take blood samples from six pigs from each fattening farm (**Table 8.k**). The documentation maintained by meat control personnel enables the findings to be related back to the individual fattening farm. By examining six animals, we can achieve a herd sensitivity of 80%, based on the assumption that the prevalence on an infected farm will be 30%.

Animal disease	Animal category	Samples	Total number of pig farms	Farms included in the sample	Period of sampling
Aujeszky's disease	Fattening pigs	6 blood samples from individual animals from a fattening farm	7,692	1,340	1.1.2014–31.5.2014

Table 8.k: The total number of pig farms in Switzerland, together with the calculated size of the sample population per farm; samples are taken from 6 fattening pigs per farm

8.4.5 Laboratory analyses

The blood samples taken by meat control personnel are sent to the designated diagnostics laboratories, where they are tested for antibodies against Aujeszky's disease and PRRS. Any type of laboratory-based diagnostic method can give rise to a false-negative or a false-positive result, however this occurs only rarely and only under certain conditions. The way in which this problem is approached in the context of screening programmes is described in the section devoted to IBR (see Section 8.1.5). The methods used in the screening and the confirmatory analysis for Aujeszky's disease, the sensitivity and specificity that apply in each case and details of the reference laboratory for Aujeszky's disease are given below (**Table 8.l**).

Animal disease and type of sample	Screening method	Sensitivity and specificity 1) [%]	Method used during confirmatory analyses of samples that tested positive	Sensitivity and specificity [%]	Reference laboratory
Aujeszky's disease, blood samples	ELISA	99.5 and 99.9	Serum neutralisation test (SNT)	Gold standard ≥ 99.5	Virological Institute of the Vetsuisse Faculty of the University of Zurich

Table 8.l: Methods used during screening for Aujeszky's disease, including sensitivity and specificity and details of the reference laboratory for Aujeszky's disease

8.4.6 Case definition

The Animal Diseases Ordinance stipulates that in the case of Aujeszky's disease, any pig confirmed by the reference laboratory to be carrying antibodies shall be deemed to be infected and that measures must be taken on the farm concerned. As a variety of scenarios can give rise to a positive test result (see Section 8.1.6), it is important to investigate the situation in more detail and to distinguish singleton reactors from a genuine outbreak of the disease.

8.4.7 Results 2004–2014

Since 2006, random samples have been taken from pigs at the abattoir and are tested for Aujeszky's disease and PRRS. From 2001 to 2004, samples were taken from breeding sows at the point of slaughter or on the farm. From 2004 to 2014, none of the samples taken were confirmed to be positive for Aujeszky's disease (**Table 8.m**).

Year	Number of farms tested	Number of samples tested	Screening of samples that tested positive	Confirmations of samples that tested positive	Certainty of disease-free status obtained [%]
2014	1,253, of which 1,252 with six or more blood	8,226	16	0	99.03
2013	1,267	8,305	37	0	99.06
2012	1,294	8,747	3	0	99.08
2011	1,258	8,897	24	0	99.04
2010	1,237	8,677	3	0	99.10
2009	1,268	9,349	6	0	99.10
2008	1,322	9,296	2	0	99.10
2007	1,316	9,597	16	0	99.20
2006	1,362	9,659	–	0	99.20
2005	1,139	7,526	14	0	99.20
2004	1,074	7,498	–	0	99.10

Table 8.m: Results of the samples taken since 2004 in order to detect cases of Aujeszky's disease

8.4.8 More detailed epidemiological investigations arising from surveillance activity

During the period of 2004–2014, there were no special events in connection with Aujeszky's disease. No investigations therefore needed to be carried out.

8.4.9 Conclusion

Switzerland also successfully provided evidence of disease-free status for Aujeszky's disease in 2014. As in the preceding years, the level of certainty obtained by random sampling was higher than the level required by the EU.

8.5 Brucella melitensis

Brucellosis in sheep and goats is caused by *Brucella melitensis*, a facultative, intra-cellular gram-negative bacterium. Following an incubation period of several weeks, this condition is the cause of high abortion rates or the birth of less viable lambs. The placenta appears thickened and oedematous and displays purulent-necrotising lesions in the vicinity of the cotyledons. Foetuses may be covered by yellowish membranes and the placenta is often retained post-partum. In a few cases, a mucal, purulent grey-white to reddish vaginal secretion may be observed a few days before the birth. Transmission takes place both horizontally and vertically. A typical symptom encountered in male animals that have become infected is a swelling of the testicles.
This disease is a classic example of a zoonosis, and the bacterium can also affect humans. In humans, the disease is known as Bang's disease, Malta fever or Febris undulans. The other types of *Brucella* are also zoonotic, to a greater or a lesser degree (see Section 9.7).
Infected animals secrete the pathogen mainly through the sex organs and mammary glands. Transmission primarily takes place via infected semen, milk and lochia. Entry takes place orally or via lesions in the skin or mucous membranes.
The most recent case of brucellosis in sheep and goats in Switzerland occurred in 1985. Since 1998, the country's disease-free status in relation to brucellosis amongst the population of small ruminants is being monitored by means of examinations of aborted foetuses and an annual screening programme. Alongside Switzerland, Belgium, Denmark, Germany, Sweden, Finland, Ireland, Luxembourg, the Netherlands and the United Kingdom are free of brucellosis. Regular random sampling programmes are also carried out in those countries. Other countries, however, such as France, Italy, Portugal and Spain, have only been successful in ensuring that certain regions of the country are disease-free.
In the case of imports from regions that are not brucellosis-free, small ruminants must undergo a special quarantine programme. Trade between disease-free regions may not be subjected to regulation.

8.5.1 Procedure to provide evidence of disease-free status

In order to provide evidence of disease-free status in relation to brucellosis, the following conditions must have been fulfilled in advance (this is explained in Section 8.1.1):

- No signs of brucellosis
- Compulsory reporting of disease and any suspected cases
- Disease awareness and effective early detection in place

A typical symptom of brucellosis in small ruminants are aborted foetuses. To ensure effective surveillance, it is therefore important that a flock of sheep or goats with a noticeably high rate of aborted foetuses should be tested for brucellosis, despite the fact that in general, a different cause is usually assumed, as brucellosis does not occur endemically amongst small ruminants in Switzerland. On a farm that is infected, the primary causes of a rapid spread of the disease are lambing or breeding. This causes the majority of animals to be infected and to test positive during serological tests.
As a result of the bilateral treaties with the EU, it is sensible, when providing evidence of disease-free status in relation to brucellosis, to carry out a screening programme for brucellosis using random sampling, so that live sheep and goats and any products derived from them can be exported to other brucellosis-free countries. The importation of live sheep and goats, or of their semen, can also be regulated. An important pre-condition for such trade relationships is the comparability of disease-free status in the various countries involved, in other words, the statements on which disease-free status is based must be backed up in the form of relevant statistics. The screening programme operated in Switzerland fulfils that requirement.

8.5.2 Calculation of the random sample

The random sample is determined in accordance with statistical principles. In order to carry out the sampling in the most cost-effective possible way, the Federal Food Safety and Veterinary Office (FSVO) has developed additional methods and has refined them (see Section 8.1.2).
In the case of brucellosis, a risk-based random sample calculation is used. The reason for this is that the risk of brucellosis being brought into the country is very small and that since the introduction of random sampling, no further outbreaks have occurred in Switzerland. For that reason, the reduced quality of surveillance provided by the random sampling associated with this procedure is not of concern and it is therefore possible to utilise the economic benefits generated by this procedure.
In accordance with the bilateral treaties, evidence must be provided of a herd prevalence of below 0.2% that has been established to a certainty of 99%. To that end and in accordance with an EU Directive (91/68/EEC), sheep and goats may be counted together as a single population.
Blood samples are taken to serve as the sample for testing for the presence of brucellosis in sheep and goats. At goat farms, additional samples are also taken in order to diagnose Caprine Arthritis-Encephalitis. When evaluating the sample, we apply the Bayesian method (see Section 8.1.2). In the evaluation of the current random sample, we take account of a decline in certainty of the previous random samples of 10% per year, in so far as no more than 600 small ruminants were imported during the previous year. This standard deduction was intentionally calculated generously, in order to ensure that the certainty associated with the current sample will not ultimately be overestimated. Nevertheless, a total of 681 small ruminants were imported in 2013. For that reason, we were unable to make use of the standard deduction and calculate the residual certainty of the random samples taken from previous years. This came to 90.53% and was therefore higher than the standard deduction. The calculations for the size of the sample population in 2014 are therefore based on the level of residual certainty established by means of this calculation.

8.5.3 Selection of farms

In order to obtain the sample to test for brucellosis, farms are selected at random from the Agricultural Policy Information System (AGIS). Goat farms must register at least 3 goats in the AGIS and must be included as a sheep or goat farm in the Animal Transport Database (TVD). In addition, they must not have been screened for brucellosis during the previous 3 years.

8.5.4 Selection of livestock

Sheep and goats aged over 12 months are screened for brucellosis. In the case of larger herds, animals will be tested at random. Animals are selected at random for inclusion in a sample and are stratified according to the epidemiological units of the farm. The number of samples taken from sheep and goat farms (**Table 8.n)** guarantees a suitable herd sensitivity of 99%. The herd sensitivity corresponds to the probability that an infection that is present within a herd will be detected using random sampling. This will depend upon the sensitivity of the individual animal diagnostics employed, from the number of infected animals in the herd and the number of animals examined. The larger the sample, the greater the probability that an infected farm will be detected.

Herd size (number of animals older than 12 months)	Number of blood samples
< 40	all
40-99	40
≥ 100	50

Table 8.n: Number of sheep and goats to be sampled for the purpose of screening for brucellosis

8.5.5 Laboratory analyses

The blood samples are taken on the farms by designated veterinarians and undero diagnostic analysis at laboratories accredited by the Federal Food Safety and Veterinary Office (FSVO). The designated veterinarian must complete a collection report for each farm, even if no samples were actually taken. If he/she was unable to take any samples, the reasons for this must be given.
The laboratory will then analyse the samples for antibodies against brucellosis. Any type of laboratory-based diagnostic method can give rise to a false-negative or a false-positive result, however this occurs only rarely and only under certain conditions. The way in which this problem is approached in the context of screening programmes is described in the section devoted to IBR (see Section 8.1.5). The methods used in the screening and the confirmatory analysis for brucellosis, the sensitivity and specificity that apply in each case and details of the reference laboratory for brucellosis are given below (**Table 8.o**).

Animal disease and type of sample	Screening method	Sensitivity and specificity 1) [%]	Method used during confirmatory analyses of samples that tested positive	Sensitivity and specificity [%]	Reference laboratory
Brucellosis, blood samples	ELISA	No information	Complement binding test and agglutination test	No information	ZOBA, Institute for Veterinary-Bacteriology of the Vetsuisse Faculty of the University of Bern

Table 8.o: Methods used during screening for brucellosis, including sensitivity and specificity and details of the reference laboratory for brucellosis

The sensitivity and specificity of the laboratory tests have not been published in any scientific journal. Nevertheless, the analyses carried out by the reference laboratory and all experiences gained to date have shown that the tests are very effective and are suitable for use in providing evidence of disease-free status. Animal keepers can expect to receive a negative result in view of the fact that before the samples taken during spot checks are analysed, it is assumed that Switzerland is free of brucellosis. For that reason, no laboratory reports are sent if the results of the analysis are negative.

8.5.6 Case definition

The Animal Diseases Ordinance stipulates that in the case of brucellosis, any small ruminant confirmed by the reference laboratory to be carrying antibodies shall be deemed to be infected and that measures must be taken on the farm concerned.
As a variety of scenarios can give rise to a positive test result (see Section 8.1.6), it is important to investigate the situation in more detail and to distinguish singleton reactors from a genuine outbreak of the disease. In the case of brucellosis, however, hardly any singleton reactors occur in reality.

8.5.7 Results 2004–2014

Since 1998, the year in which screening programmes involving random sampling were first carried out in order to provide evidence of disease-free status in relation to brucellosis, no further outbreaks have occurred in small ruminants (**Table 8.p**). During that period, however, other types of brucellosis have been evidenced in other species, such as the semi-wild Mangalitsa pigs found to be carrying porcine brucellosis (*B. suis*) in 2009. In sheep, a case of brucellosis in rams was recorded in 2010 (*B. ovis*, which only occurs in sheep). As far as the country's disease-free status in relation to brucellosis in ruminants is concerned, these findings are of no relevance.

Year	Number of sheep farms tested	Number of goat farms tested	Number of samples tested	Screening of samples that tested positive	Confirmations of samples that tested positive	Certainty of disease-free status obtained [%]
2014	688	471	12,281	0	0	99.20
2013	751	476	26,194	0	0	99.30
2012	542	716	14,404	1	0	99.30
2011	681	526	16,028	0	0	99.06
2010	697	527	13,244	2	0	99.20
2009	700	358	15,330	0	0	99.30
2008	607	358	11,212	0	0	98.60
2007	758	387	13,966	0	0	99.60
2006	542	471	11,329	0	0	99.00
2005	673	592	13,787	4	0	99.00
2004	848	516	15,656	0	0	99.00

Table 8.p: Results of the random samples taken since 2004 in order to detect cases of brucellosis in small ruminants

With the exception of 2008, it has always been possible to arrive at the required level of certainty. We therefore categorised a deviation of 0.4% in 2008 as being so small, that we decided to forego carrying out any additional sampling. Since 2011, the level of certainty has been only slightly higher than the level of 99% required by the EU. This effect was intentional. In order to carry out only as many analyses as necessary, we refined the process used to select the farms and have managed to reduce the number of farms on the back-up list on a continuous basis. This is a relatively costly process, as in the case of the random sampling carried out in order to screen for brucellosis, up to 20% of all farms could not be tested, due to the fact that no small ruminants were actually present on the farm for samples to be taken at the time at which the tests were carried out.

8.5.8 More detailed epidemiological investigations arising from monitoring activity

During the period of 2004–2014, there were no special events in connection with brucellosis in small ruminants. No investigations therefore needed to be carried out.

8.5.9 Conclusion

Switzerland also successfully provided evidence of disease-free status for brucellosis in small ruminants in 2014. As in the preceding years, the level of certainty obtained during the programme of random sampling was higher than the level required by the EU.

8.6 Bluetongue disease

Bluetongue is triggered by the bluetongue virus (BTV). Of this virus, 26 different serotypes that can be distinguished from one another by means of serological analysis methods, are known world-wide. The serotypes differ considerably in the range of hosts that they use and in their ability to cause disease. The virus is not transmitted from animal to animal, but mainly by means of blood-sucking insects, such as midges of the genus*Culicoides* (over 1,200 species, belonging to the gnat family). Only certain types are capable of spreading BTV. Sheep, goats, cattle and other ruminants are especially susceptible to the bluetongue virus. Bluetongue is capable of spreading rapidly. The dynamics of transmission are substantially influenced by the density of the midge populations and the density of the animals that may become infected. These will determine the rate of transmission and the reproduction rate of the virus.
The incubation period is only a few days. All ruminants can be infected. For the most part, sheep are affected, while cases involving goats and cattle occur more rarely. The animals suffer from a high fever and appear listless. Typical symptoms also include conjunctivitis, hyperaemia and an inflammation of the mucous membranes, following by the formation of crusts on the muzzle, lips and nose. Typical symptoms include a subcutaneous oedema, accompanied by a swelling of the head and an inflammation of claw seam. In severe cases, the tongue swells up in such a way that it takes on a blue colour and causes laboured breathing. Based upon these symptoms, bluetongue in its acute form is an important differential diagnosis for foot and mouth disease. The disease can progress from acute to chronic. Practically all of the animals in affected herds become infected and form antibodies against the virus. Morbidity and mortality, however, vary greatly and primarily depend upon the particular serotypes involved, the species and the immunity status of the animals.
The first case of bluetongue in Switzerland was triggered in 2007 by a bacterium of serotype 8. Subsequently, between 2008 and 2010, Switzerland ordered that all cattle and sheep, and some goats, be vaccinated. A total of 76 cases of bluetongue were recorded up to mid-2010. No clinical cases of bluetongue have been notified since autumn 2008. The most recent recorded case was discovered in spring 2010 and was based on evidence of the virus genome (PCR). Both in infected and vaccinated animals, antibodies against BTV-8 can still be detected several years later. Based upon the surveillance outcomes during the preceding years, Switzerland and the Principality of Liechtenstein declared themselves to be free of bluetongue in 2012. This declaration corresponds to the requirements of the World Organisation for Animal Health (OIE) and of the EU. In Europe, bluetongue with the serotypes of 1, 2, 4, 8, 14 and 16 still occurs. For that reason, countries that are free of bluetongue must demonstrate their disease-free status by carrying out a screening programme. In the case of imports from regions that are not BT-free, cattle must undergo a special quarantine programme. Trade between BT-free regions may not be subjected to regulation.

8.6.1 Procedure to provide evidence of disease-free status

In order to provide evidence of disease-free status in relation to bluetongue, the following conditions must have been fulfilled in advance (see Section 8.1.1):

- No signs of BT at all

By virtue of international agreements, the screening programme is a necessary part of providing evidence of disease-free status, in order to regulate the importation of ruminants and any products derived from them and to export them to BT-free countries.

In order to confirm disease-free status, the EU requires that a screening programme be carried out in BT-free regions in order to exclude a prevalence of 20% at livestock level, to a level of certainty of 99%. In addition, surveillance must also be carried out in regions where bluetongue is present. Those areas are defined as squares covering an area of 2,000 square kilometres. Nevertheless, it is permitted to deviate slightly from this definition, in order to accommodate existing administrative boundaries. Using geo-statistical processes, we have subdivided these bluetongue surveillance areas in such a way that they largely coincide with the boundaries of the Swiss cantons. In this way, a total of 16 bluetongue areas have been designated in Switzerland, as several small cantons have been merged together to form a single bluetongue area. Furthermore, we took care to ensure that not only the surface area, but also the populations of the relevant animal species are around the same size in all bluetongue areas. In this way, it is possible to examine the same number of livestock in each of the bluetongue areas.
As the required prevalence on livestock level is very high and already corresponds to the level associated with an advanced epidemic, we have decided that the Swiss screening programme must fulfil more stringent requirements. The reason for this is to ensure that an outbreak can be detected at the earliest possible stage and to ensure that measures can be taken at an early stage. These requirements correspond to the prevalence observed in bluetongue areas during the outbreaks in 2007/2008. Switzerland has therefore imposed the following new requirements with regard to the screening programme: On a national level, the detection of a prevalence at livestock level of 2% with 99% certainty; in each of the 16 bluetongue areas, the detection of a prevalence at livestock level of 20%, also with 99% certainty. An important pre-requisite when it comes to ensuring the comparability of the evidence of disease-free status provided by individual regions and countries, is that the quality of surveillance and the results obtained therefrom are comparable, that is, it will be necessary for any statements to be backed up by statistics. The scientific and statistical foundation for the screening programme operated in Switzerland fulfils this requirement.

8.6.2 Calculation of the random sample

Important aspects of the random sample calculation are described in the section referring to IBR (see Section 8.1.2). The method used in the case of bluetongue differs, however, from the one used for IBR. During an initial stage, we first calculate the size of the sample population per bluetongue area, based upon the average population size of a bluetongue area. This sample population per bluetongue area is then multiplied by 16, in order to arrive at the necessary size of the sample population. We then calculate the validity of this size of population on a national level. If this is insufficient in order to achieve the required level of certainty of 99%, we then calculate during a second stage the necessary size of population on a national level directly and then distribute that number across the 16 bluetongue areas. In 2014, the the sample sizes in each bluetongue area was 150 cattle. Throughout Switzerland as a whole, a total of 2,400 cattle had to be screened, in order to fulfil the requirement. From the experience gained during previous screening programmes, we estimated the necessary additional number was 490 animals. In the case of bluetongue, the reserve ensures that in all bluetongue areas, the planned screening numbers will actually be achieved.

8.6.3 Selection of livestock

Blood samples are taken at 4 major slaughterhouses in Switzerland. Both the sampling itself and the selection of the cattle are carried out by meat control personnel on site. For that purpose, the animals themselves must fulfil the following criteria:

- They must not have been vaccinated. For that reason, samples are only taken from cattle born after May 2010.
- The cattle must be at least 8 months old. That way, maternal antibodies can be excluded and it is also possible to ensure that the animals have been exposed for as long a time as possible to any potential transmission.

Wherever possible, only individual cattle from each farm should be tested. The designated meat control personnel fulfil this requirement by maintaining their own documentation regarding the farms from which the animals originated. The samples required during the course of the programme in 2014 were taken between 3.3.2014 and 28.3.2014, and between 5.5.2014 and 30.5.2014.

8.6.4 Laboratory analyses

For the purpose of the bluetongue screening programme, blood samples from individual livestock are analysed (**Table 8.q**). Once the animals have been slaughtered, the blood samples are taken from the animals. They are then sent to one of several laboratories accredited by the Federal Food Safety and Veterinary Office (FSVO) and are individually analysed. The traceability with regard to the farms of origin can be achieved using the information from the meat control or by referring to the animal history contained in the Animal Transport Database.
Diagnostics will focus upon demonstrating the presence of antibodies against all serotypes of the bluetongue virus. Important aspects during the testing for antibodies and the procedure to be adopted are described in the section relating to IBR (see Section 8.1.5). In addition, in the case of bluetongue, the serotype against which antibodies are encountered is identified, together with the virus itself. The presence of the bluetongue virus in the blood cells may still be demonstrated, even if antibodies are already present in the serum.
A seropositive result may also be caused by an earlier vaccination, though this does not constitute any risk for the herd as a whole. This possibility must therefore be investigated in the case of all seropositive findings. Vaccination against the bluetongue virus is not prohibited in Switzerland.

Animal disease and type of sample	**Screening method**	**Sensitivity and specificity [%]**	**Confirmatory analysis in the case of positive samples**	**Sensitivity and specificity [%]**	**Evidence of virus**	**Sensitivity and specificity [%]**	**Reference laboratory**
Bluetongue virus, blood samples	ELISA	98 and 99	Serum neutralisation test (SNT)	No information	PCR from the Coagulum	99.99 and 99.99	Institute of Virology and Immunology (IVI), Mittelhäusern

Table 8.q: Methods used during screening for bluetongue, including sensitivity and specificity and details of the reference laboratory for bluetongue

Animal keepers from the farms tested can expect to receive a negative test result in view of the fact that before the samples taken are analysed, it is assumed that Switzerland is free of bluetongue. For that reason, no laboratory reports are sent if the results of the analysis are negative.

8.6.5 Case definition

The Animal Diseases Ordinance stipulates that in the case of bluetongue any animal that tests positive constitutes an occurrence of the disease and that measures must be taken on the farm concerned.
If only antibodies are found in the sample taken as part of the screening programme, this means that the animal has been in contact with the virus at some point in the past. That may mean, however, that the animal has been vaccinated and is therefore incapable of infecting others. If, in the case of an animal that tests positive for antibodies, it is impossible to demonstrate that it had been vaccinated, the susceptible animals on the farm of origin must be examined for bluetongue by a veterinarian. A minimum

of five blood samples must be taken and tested for the bluetongue virus. This procedure was laid down in such a way that it would enable an outbreak of bluetongue on the farm of origin to be ruled out. To do this, all samples must test negative for the bluetongue virus and for antibodies.

8.6.6 Results 2004–2014

Sampling in 2014

Serological tests of 12 animals were positive during the screening programme in 2014. Of those animals, 11 did not fulfil the age requirement for the screening programme. These animals were either too old or too young and had therefore been vaccinated or had gained immunity in a passive way through exposure to maternal antibodies. An animal from the correct age segment also tested positive in the serological test. Following testing of additional animals on each of the two farms of origin, no further animals tested positive. All tests for the presence of the virus were negative. The size of the sample populations per bluetongue area were very different. An evaluation of individual bluetongue areas was not possible, as the information regarding the farm of origin was incomplete and would have required extensive reworking. On a national level, it was possible, to a degree of certainty of 99%, to provide evidence that the prevalence in Switzerland is below 0.2%. A prevalence of that figure would correspond to 2,850 infected animals.

Outbreak in 2007-2010

In Central and Northern Europe, bluetongue is an emerging disease. The transmission area of the disease has continuously expanded geographically in a northerly direction. In addition, increasing numbers of species of *Culicoides* midges are becoming effective transmitters of the bluetongue virus. The most significant event with regard to bluetongue was the Europe-wide epidemic during the period from 2006 to 2010. This was triggered by serotype 8. Whilst the number of cases in France, the Benelux countries and Germany rose into the tens of thousands, Switzerland was only marginally affected, with 75 cases. One of the reasons for this was because Switzerland had been carrying out monitoring for bluetongue since 2003. Those efforts with the intention of identifying the importation of the bluetongue virus were originally directed towards the possibility of the disease being brought into the country from the South. After the disease broke out in the Benelux countries, the surveillance programmes were rapidly able to adjust to the latest situation. The discovery of the first cases in the late autumn of 2007 took place at a very early stage in the same region. On the one hand, this was due to suspected clinical cases, whilst on the other hand, cases were also discovered via samples taken from milk in storage tanks from selected Sentinel farms. Both parts of the surveillance processes have been found to perform very well. Alongside the provision of an effective surveillance programme, the prompt commencement of vaccinations in 2008 also played a decisive role when it came to preventing even greater losses and larger numbers of cases. As it was no longer possible to carry out serological testing on samples of milk taken from storage tanks once livestock had been vaccinated, the screening programme has been carried out upon young, non-vaccinated animals since 2009. The subdivision of the country into bluetongue areas and the size of the random samples have not changed since 2009. Based upon the results of the surveillance system, the country was able to achieve disease-free status in relation to bluetongue in 2012. For that reason, no screening programmes for bluetongue were carried out in 2012 and 2013. In view of the EU requirement that even countries that are free of bluetongue must obtain evidence of their disease-free status, a further screening programme was commenced in 2014. In view of the fact that each year since 2012, BTV-4 has been moving closer to Switzerland at a distance of several hundred kilometres a year from the South East, that screening programme also has an important part to play when it comes to detecting at an early stage that BTV-4 has been brought into the country.

Observation of the type of midge responsible for transmission

Another requirement imposed by the EU is that the observation of the types of midge responsible for transmission should form part of the surveillance of the bluetongue virus. To this end, a special midge

trap must be operated in each of the bluetongue regions. During the period from 2007 to 2011, Switzerland carried out these observations and was able to identify the "midge-free period" in this way. For that reason, it is no longer necessary to carry out observations of the midge.

Analysis of milk samples taken from storage tanks
When it comes to creating a cost-effective, country-wide serological screening programme, the analysis of milk samples taken from storage tanks is an especially suitable method. That is why since 2012, the Federal Food Safety and Veterinary Office (FSVO) carries out serological testing of milk samples taken from storage tanks at 200 dairy cattle farms, three times a year, to establish the presence of the bluetongue virus. These analyses show that at practically all farms, the majority of cows still carry antibodies against BTV-8. This is a result of the vaccination campaigns during the period from 2008 to 2010. Nevertheless, in the case of the bluetongue virus, only vaccinations of the same serotype can provide reliable protection against infection. As a result, there is currently no immunity against BTV-4, which is approaching Switzerland from South-Eastern Europe. Vaccines against BTV-4 are available, but at the present time, are not approved for use in Switzerland.

8.7 Avian influenza and Newcastle disease

Highly Pathogenic Avian Influenza (HPAI) poses a danger to animals and humans. After HPAI-H5N1 started to become rampant amongst flocks of poultry in Asia in 2003, the HPAI virus spread ever further westwards, reaching Western Europe in autumn 2005. This was the reason that intensive surveillance of commercial poultry and wild birds was launched in 2006.

In commercial poultry, infections with HPAI mostly give rise to clear and visible clinical symptoms. As a result, these are covered by the system of passive surveillance that is in place. Low Pathogenic Avian Influenza Virus (LPAIV) of the sub-types H5/H7 can turn into strains of HPAI as a result of reassorting or mutations within the genome. As LPAIV infections mostly give rise to mild and less specific symptoms of illness, their occurrence can only be identified in commercial poultry at an early stage by means of an active system of surveillance.

Screening for antibodies against Newcastle disease (ND) enhances the passive surveillance for ND, thereby providing additional indicators of disease-free status. ND is caused by the avian paramyxovirus, serotype 1 (APMV-1).

8.7.1 Surveillance for LPAI in commercial poultry

8.7.1.1 Procedure

Blood samples from commercial poultry in Switzerland have been analysed to detect the avian influenza viruses (AIV) H5/H7 and antibodies against ND, since 2006. The particular livestock categories from which samples are taken are heavily dependent upon the current situation concerning avian influenza in Switzerland and in Europe. The surveillance work that is carried out is continually adjusted in the light of the latest findings. **Table 8.r** shows how many flocks from which livestock categories were sampled, and where.

Sampling		2006	2007	2008	2009	2010	2011	2012	2013	2014
Blood samples at the slaugh-terhouse	Laying hens- **Flocks** (and/or **farms***) [+Safehouse flocks]	64	62 [+26]	70 [+22]	66 (64)	64 (61)	40 (37)	102 (96)	89 (82)	79
	Broiler chickens	60	43	58	–	–	–	–	–	–
	Fattening tur-keys	48	–	–	–	–	25	23	23	22
On the farm		146 1	44 2	202 3	43 4	–	–	–	–	–

1 Farms holding an approved exemption from the Free Range Prohibition (serological)
2 Laying hens in at-risk areas (egg yolk serology)
3 Hobby livestock-keeping and duck or geese holdings (virological)
4 Duck or geese holdings (serological)

Table 8.r: Number of **flocks** examined 2006–2014
*each year, samples are taken from several flocks per year at certain farms

Reasons behind the decision to make changes:

- No screening was carried out of flocks of laying hens in defined at-risk areas by means of egg yolk serology in 2008, as more intensive monitoring of around 202 duck and geese holdings and very small-scale chicken holdings in the at-risk areas was carried out (Ordinance of 28 September 2007 concerning precautionary measures to prevent the introduction of avian influenza (CC 916.403.11)). This type of monitoring replaced the universal obligation for poultry holdings in at-risk areas to keep their birds indoors. In addition, 202 hobby holdings with fewer than 100 chickens or turkeys and duck and geese holdings (irrespective of the number of animals kept) were subjected to virological screening for HPAI (especially H5N1).
- In winter 2008/2009, it was decided not to designate any at-risk areas. Instead, a recommendation was made to analyse a certain set of samples of duck and geese holdings in 2009, within the framework of the active monitoring programme for LPAI, as these would not display any symptoms, even if infected with HPAI.
- In the case of fattening chickens, there is only a small risk of infection with AIV, as a result of the short production cycle. As surveillance within the EU had never yielded any positive indications, serological screening was ceased in 2009.
- Though ducks and geese are at a greater risk of coming into contact with AIV, the risk that LPAI may be spread is assessed as low, as the hobby or pure breed poultry holdings (< 50 ducks/geese) have hardly any contact with commercial poultry holdings. As the extraction of samples from ducks and geese is only possible using labour-intensive methods?, serological testing was ceased in 2010.
- Fattening turkeys are fattened for longer periods than fattening chickens. As fattening turkeys in Switzerland are also kept outdoors and in view of the fact that inside the EU, 6 turkey holdings tested positive during serological tests for H5/H7 in 2009, fattening turkeys were included in the screening programme in 2011.

8.7.1.2 Random sample calculation

The number of flocks to be screened was determined in such a way that in the case of a farm-based prevalence of 5% and proven certainty of 95%, at least one farm infected with LPAIV would be found. In the case of Switzerland, which has over 250 laying hen farms, this would involve a random, representative sample of 60 farms. Samples are taken from all turkey farms on an annual basis.
The number of animals to be screened per flock is laid down in such a way that in the case of a prevalence of ≥ 30% of LPAIV seropositive animals, at least one LPAIV-seropositive animal can be detected with a proven certainty of 95%. Samples must therefore be taken from a total of 10 animals per flock. In the case of turkeys, samples were taken from 15 animals per flock up to 2013, due to the fact that in the previous EU Decision 2007/268/EU, turkeys were included together with ducks and geese.
In the laboratory, the existing samples from the LPAI screening programme are also screened for ND antibodies. As the samples are not taken for the purpose of calculating disease-free status, they are not suitable for use as such.

8.7.1.3 Selection of farms

The Federal Food Safety and Veterinary Office (FSVO) selects free-range laying hen farms based upon the regularly updated slaughter lists kept by Gallo Circle, a society operated by the egg producers' association, Gallo Suisse. Most of all, flocks slaughtered in close succession are selected, in order to minimise the expense incurred for the dispatch of samples from the slaughterhouse, which is located in Germany. As a result of the restriction, which requires that only flocks of free-range laying hens sent to slaughter should be sampled, the choice of flocks is relatively limited and the farms that are screened each year are very similar. 2012 may be used as an example of the approximate geographical distribution (**Figure 8.a**). In the case of turkeys, samples are taken from all turkey farms on an annual basis.

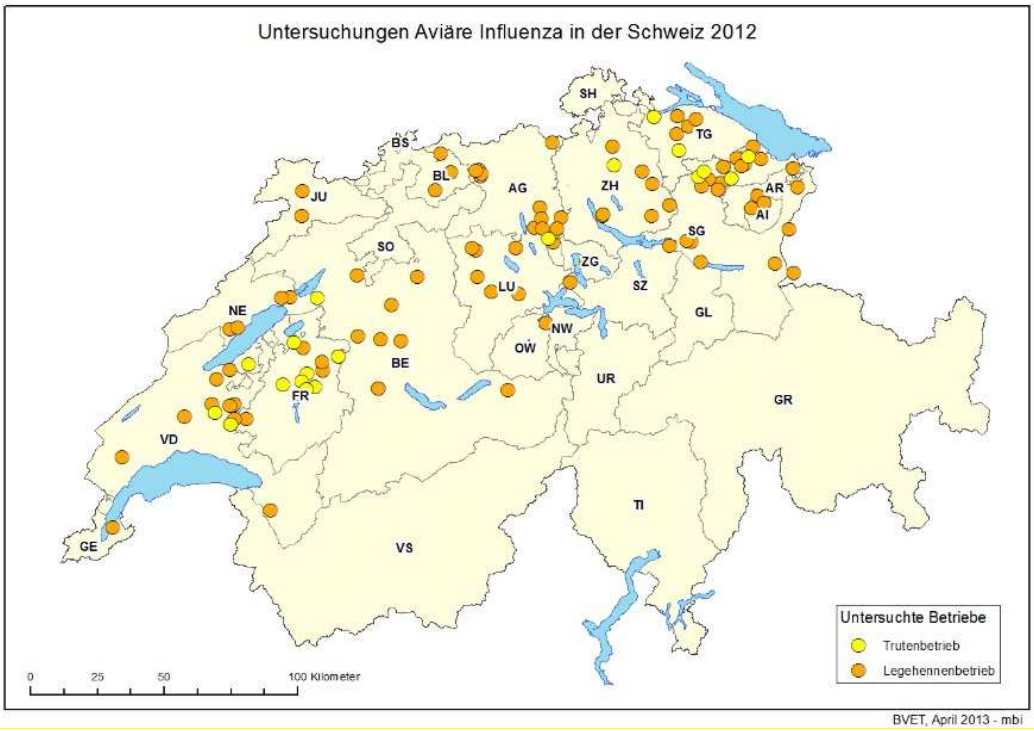


Figure 8.a: Geographical distribution of farms subjected to screening (as in 2012)

8.7.1.4 Laboratory analyses

The laboratory analyses are carried out at the Institute for Virology and Immunology (IVI). The diagnostic procedures correspond to the requirements of the World Organisation for Animal Health (OIE). All blood samples were tested using commercially-available ELISA tests that are validated at the IVI (competitive AI/blocking ND). Positive and questionable samples were retested using a confirmatory ELISA (blocking AI/indirect ND) test. In the case of sera that still tested positive using the ELISA test, a haemagglutination inhibition test (HIT) was carried out in order to demonstrate the presence of antibodies against the AIV sub-types H5/H7 or against the avian paramyxovirus, serotype 1 (APMV-1).

8.7.1.5 Case definition

In the case of an infected flock, one would expect to encounter antibodies in several animals. Flocks, in which only a single animal yields a questionable test result, are categorised as negative and no further tests are carried out. Only if several animals belonging to a single flock generate a positive of questionable result will a farm be categorised as positive for the presence of antibodies. In such cases, the subsequent flocks, or, in the case of multi-year farms, the remaining flocks on the farm will be subjected to serological and virological testing and epidemiological investigations carried out.

8.7.1.6 Results 2006–2014

In 2014, no antibodies against AIV were found in laying hens or fattening chickens. Since screening for AIV, subtypes H5/H7 began in 2006, serological tests in laying hens, broiler chickens and turkeys carried out in the screening years were negative (see **Table 8.s**). In the case of a flock of laying hens from an at-risk area in 2007, contact with AIV of a different subtype to H5/H7 was supposed to be the cause. All livestock holdings operated as a hobby (including duck and goose holdings) in at-risk areas that were screened in 2008, were AIV negative. On the other hand, however, antibodies against H5/H7-AIV were evidenced in samples taken from duck and geese holdings in 2009. Furthermore, antibodies against ND were encountered in commercial poultry on an isolated basis. In 2014, however, all samples tested negative.

Year	Category of animals	Antibodies positive	Number of herds testing positive	Cantons affected
2007	Laying hens	not H5/H7-AIV	1 of 441	1 x Lucerne
2009	Ducks/geese	H5/H7-AIV	4 of 43	2x Basel Landsch.; 2x Aargau
2009	Laying hens	ND	1 of 66 2	1 x Basel Landsch.
2012	Laying hens	ND	1 of 1022	1x Geneva
2013	Fattening turkeys	ND	1 of 23 2	1x Fribourg

Table 8.s: Evidence of antibodies against AIV and/or NDV - 2006-2014

1 In the case of a flock of laying hens with organic certification in the canton of Lucerne (in the at-risk area of the Vierwaldstättersee), suspect results obtained from eggs submitted resulted in an order requiring the flock to be investigated by carrying out a follow-up screening involving the serological testing of blood samples. The results from the sera also indicated that the birds had been in contact with AIV. By carrying out a haemagglutination inhibition test (HIT), it was possible to rule out reactions specifically associated with H5/H7. No clinical symptoms deemed to exist.
2 For further information regarding the epidemiological investigations, please see Section 8.7.1.7.

8.7.1.7 More detailed epidemiological investigations arising from monitoring activity

2013

In the case of fattening turkeys found to have antibodies against avian paramyxoviruses, those animals belonged to the final batch of animals from the flock to be sent for slaughter. This meant, therefore, that no further animals were left on the farm. Animals at other farms that came from the same delivery of hatching eggs had also already been slaughtered. No clinical symptoms deemed to exist. The farm had accommodated the fattening animals as one-day-old chicks. The hatching eggs came from Canada and both parents had been vaccinated against ND. It cannot be assumed that these cases involved maternal antibodies, due to the fact that, at the age that the fattening turkeys had reached, such antibodies ought not to have been detectable. Whether the hatching eggs had come into contact with ND vaccine in Canada and the chicks could therefore have become infected in that way, remains unclear.

In late 2013, a total of seven farms in the canton of Geneva were subjected to active monitoring, due to the results obtained during the previous year. In December 2013, two additional farms were found to contain chickens carrying antibodies against ND. No virus was detectable, however, and the chickens were all clinically healthy.

2012

Antibodies against avian paramyxoviruses were also found in other livestock, at the laying hens farm in the canton of Geneva - including a peafowl that originally came from the botanical gardens in Geneva, as well as in the botanical garden itself. In 1 out of 5 farms within a radius of 3 kilometres of the infected farm, it turned out that the farm kept vaccinated animals that had been imported illegally from France. Based on the fact that during the course of the screenings, five out of 12 ducks in the botanical garden seroconverted, it can be assumed that a virus was circulating in the region concerned. No avian paramyxoviruses could be detected, however.

2009

A subsequent investigation of an additional flock at the laying hen farm, which in 2009 had been found to be carrying antibodies against avian paramyxoviruses, was found to be negative.

8.7.1.8 Conclusion

The prevalence of AIV infections in laying hens and fattening turkeys respectively is estimated to be very low. In the case of ducks and geese, this level may be a little higher. As the largely small holdings of pure breed poultry or poultry kept as a hobby (< 50 ducks/geese) have hardly any close contact with commercial poultry farms, the risk of transmitting LPAI to commercial poultry farms is estimated to be small.

The ND outbreak in the canton of Neuchâtel in 2011, which was discovered as a result of clinical symptoms that arose during the course of passive monitoring, and the monitoring data from 2006 onwards show that Swiss commercial poultry, at least those that are free range, can come into contact with avian paramyxoviruses. The keeping of commercial, pure breed and waterfowl in the same setting may pose a risk. Without evidence of the virus, the specific pathogens and their pathogenicity will, unfortunately, remain unclear.

In the case of imports of hatching eggs and poultry, compulsory checks should be carried out to ensure that the additional guarantees in connection with ND have been fulfilled.

8.7.2 HPAI screening programme in wild birds

Wild birds are passively monitored. A total of 5 events were reported in 2014. One of these reports involved several dead birds found at the same location. This ultimately resulted in seven wild birds (all of which were mute swans) being examined (**Table 8.t**). After 2005 and 2006, the years in which avian influenza occurred on a widespread basis, the number of screenings has significantly decreased. Up to the present time, HPAIV-positive wild birds have only been evidenced in 2006: in the cantons of Schaffhausen (14), Thurgau (9), Zurich (8) und Geneva (1), 32 wild birds tested positive for HPAIV (ducks (22), coots (4), grebes (3), swans (2), goosanders (1)).

Wild birds were also actively monitored during 2005/06 and 2006/07. The active monitoring focused upon five areas (Lake Constance, the Semperachsee, the Bolle di Magadino, Lake Geneva and Lake Neuchâtel) and involved the taking of samples from ducks, swans and coots. On Lake Constance, in the context of the Constanze research project, water birds were captured using two traps and Sentinel ducks were kept at three different locations. On the Semperachsee and in Ticino (Bolle di Magadino) wild birds were also caught using traps. On Lake Geneva and Lake Neuchâtel samples were taken during the regular waterfowl hunt. In winter 2005/2006, 749 wild birds tested negative for HPAIV. In winter 2006/2007, 6 out of 683 wild birds were found to be carrying LPAIV: 4 mallard ducks on Lake Neuchâtel and 1 mallard duck and 1 moorhen in the Bolle di Magadino.

In winter 2005/2006, 750 songbirds were also screened at ringing stations on the Ulmet peak (in the canton of Basel Land) and in the Bolle di Magadino (in the canton of Ticino). As all of the results of those tests were negative and no postive test results were known to have been obtained in other countries, no further screening of songbirds was carried out.

Year	Number of incidents	Number of dead wild birds	Number of dead wild birds examined	Number that were HPAI positive
2006	1153	1312	1175	32
2007	116	138	116	0
2008	62	78	62	0
2009	38	96	38	0
2010	6	13	6	0
2011	18	26	20	0
2012	4	9	9	0
2013	7	32	32	0
2014	5	7	7	0
Total	**1409**	**1711**	**1465**	**32**

Table 8.t: Results from the passive monitoring of wild birds 2006-2014

8.7.3 Sentinel site on Lake Constance

This Sentinel location takes the form of an open enclosure with mallard ducks, into which waterfowl are able to enter from the air. The mallard ducks are regularly screened for AIV and antibodies against AIV. The Sentinel site in the Austrian town of Bregenz is financed jointly by Austria, Germany and Switzerland. The results can be read in the interim report entitled "Die österreichische Sentinel-Anlage am Bodensee zum Zwecke der Überwachung der Vogelgrippe und anderer relevanter Pathogene" (The Austrian Sentinel site on Lake Constance for the monitoring of avian influenza and other relevant pathogens).

More detailed literature

- Commission Decision 2010/367/EU of 25 June 2010 on the implementation by Member States of surveillance programmes for avian influenza in poultry and wild birds
- Annual Report on surveillance for avian influenza in poultry and wild birds in Member States of the European Union in 2012
- Directive 2005/94/EC on Community measures for the control of avian influenza of 25 July 2005
- Commission Decision 2006/415/EC of 14 June 2006 concerning certain protection measures in relation to highly pathogenic avian influenza of the subtype H5N1 in poultry in the Community
- Animal Diseases Ordinance, Article 2, Articles 122–123
- Commission Decision 2006/437/EC of 4 August 2006 approving a Diagnostic Manual for avian influenza as provided for in Council Directive 2005/94/EC

8.8 West Nile fever

In 2014, no cases of West Nile fever (WNF) occurred that had originated in Switzerland. As long as no evidence has been found that the West Nile Virus is present inside Switzerland, one can assume that Switzerland is free of the West Nile Virus. It cannot be ruled out, however, that WNV is circulating inside Switzerland, especially amongst wild birds and midges. In 2011, the Federal Food Safety and Veterinary Office (FSVO), in conjunction with the Federal Office of Public Health (FOPH) drew up a draft document, in order to be prepared for a variety of possible situations. The two Federal Offices involved will notify one another immediately, in the event of that a case of WNF occurs in an animal or a human being. Once a year, astatus report is also drawn up and any necessary actions outlined.

8.8.1 WNF-surveillance in humans

As far as humans are concerned, laboratories have been obliged to notify the authorities of any incidences of West Nile Virus since 2006 (Ordinance of the Federal Department for Home Affairs concerning notifications by doctors and laboratories). In the case of conditions affecting the central nervous system or flu-like symptoms without a known cause, the possibility that the patient is suffering from WNF must be ruled out by means of laboratory tests. In Switzerland, up to the present time, there have been no home-grown cases of WNF, that is, cases, in which the person concerned became infected with West Nile Virus in Switzerland. Since 2010, one or two imported cases of the condition have been reported, in which the persons involved became infected with West Nile Virus abroad: one case in 2010 and 2012 and two cases in 2013. The persons involved had previously spent time in Egypt, Kosovo, Italy and Croatia.

8.8.2 WNF surveillance in animals

WNF in animals has been notifiable since 1 July 2011, initially as a disease that requires monitoring, however since 1 August 2014 as a disease belonging to the equine encephalomyelitides group that must be eradicated. Up to the present, in Switzerland, no cases of WNF have been demonstrated in animals.

Horses

In 2014, four horses and one horse in each year between 2011-2013 which displayed abormalities of the central nervous system of unknown cause, tested negative for WNF. The investigations were carried out at the Friedrich Löffler Institute (FLI), as a sub-contractor of the Institute for Virology and Immunology (IVI). In order to be able to protect horses from any possible infection, a vaccine has been approved for use in Switzerland.

Birds

In 2014 (details correct as at 21 November 2014), at the National Reference Centre for Poultry and Rabbit Diseases (NRGK), samples of brain tissue from 235 wild birds from Switzerland were tested using PCR as part of a research project, but found to be negative for West Nile Virus. Future plans include examining a number of blood samples taken from flocks of free-range laying hens, to detect the presence of antibodies against West Nile Virus. All wild birds, especially crows, sparrows, blackbirds and birds of prey that are found dead must always be sent for examination to detect West Nile Virus, especially if several dead birds are found in one location. In 2013, 6 wild birds found dead tested negative for West Nile Virus (2 sparrows, 2 pigeons and 2 common buzzards). Since 2011, no more than 6 dead birds have been examined each year.

Since 2013, mallard ducks at the Austrian Sentinel site (see Section 8.7.3.) have been tested for antibodies against West Nile Virus at the end of each year. In 2013 and 2014, no antibodies against West Nile Virus were found.

Midges

In 2014, the Spiez laboratory set itself the objective as part of a research project to optimise the methods used for the capture and analysis of midges, so that it would be possible to examine larger quantities of midges in the future. In Ticino and in other parts of Switzerland, it is intended that additional studies into midges will be carried out in 2016. Between 2011 and 2013, a number of groups of midges were screened for West Nile Virus in the cantons of Ticino and Geneva, as well as in areas north of the Alps. For the purpose of testing and depending on the species of midge and the region, between one and ten midges were grouped together. In the canton of Ticino, a total of 466 (2011), 1,429 (2012) and 605 (2013) groups of midges (*Culex*, *Aedes vexans* and *Aedes albopictus*) tested negative. In 36 groups (2012: 2.5%) and 5 groups (2013: 0.8%), non-WNV mosquito flaviviruses were discovered (0.8%), that differed significantly from the West Nile Virus. In the canton of Geneva, 62 (2011) and 214 (2012) midge groups (*Culex* only) tested negative. Furthermore, in 2013, a total of 123 groups of midges (*Culex, Aedes vexans and Aedes albopictus*) located to the north of the Alps tested negative for West Nile Virus.

9 Zoonoses

Zoonoses are infectious diseases that can be transmitted from animals to humans and vice versa. There is a legal obligation to monitor 8 zoonoses: campylobacteriosis, salmonellosis, listeriosis, verotoxin-producing *E. coli* (VTEC) infection, tuberculosis, brucellosis, trichinellosis and echinococcosis (TSV, Art. 291a). Campylobacteriosis in humans is the most frequently recorded. The reporting rate remained high in 2014. Salmonellosis is also common, although the number of cases has stagnated at a lower level since 2009. What most zoonoses have in common is that humans can protect themselves well against them, through good hygiene when handling food, pets and livestock.

For each of the 8 zoonoses that must be monitored by law, we outline below which pathogen causes the disease, how people become infected, how frequently diseases are reported, which symptoms can occur, how people can protect themselves against such an infection and how it is monitored.

9.1 Campylobacteriosis/*Campylobacter* infection

Campylobacteriosis is caused by an infection with bacteria of the *Campylobacter* species. In industrialised nations, it is currently the most frequently recorded diarrhoeal disease in humans that must be reported to the authorities. An infection with *Campylobacter* can cause abdominal pain, watery or bloody diarrhoea, increased body temperature or a high fever and sometimes vomiting. Evidence of *Campylobacter* is very often found in the intestinal tract of healthy animals (*Campylobacter* infection). Contamination of meat can occur during the slaughtering process, which is a significant source of infection for humans. Consumption of the meat and liver of poultry is a known risk factor for campylobacteriosis. If poultry is frozen before consumption or consumed without its skin, the risk of transmission is reduced. Humans can also become infected through direct contact with animals, contaminated drinking water and foreign travel, particularly to countries with low hygiene standards. To protect against sickness, transmission of the pathogen from raw meat to food that is ready to eat via the hands or kitchen utensils should be prevented. When preparing fondue Chinoise or similar dishes, separate plates must be used for the raw meat and the side dishes that are ready to eat. Hands must be washed thoroughly with soap after handling raw meat, and it must be ensured that food of animal origin, particularly poultry, is heated sufficiently. It is also essential to wash hands after going to the toilet and after contact with animals.
Campylobacteriosis tends to be rare in animals.

9.1.1 Obligation to report to the authorities and numbers of cases in humans

Diagnostic laboratories have a duty to report evidence of *Campylobacter* in humans. If there is a cluster of cases at a particular time and in a particular place (e.g. with food poisoning), doctors must also report this (ordinance of the FDHA on doctor and laboratory reports).
A total of 7,565 cases of campylobacteriosis in humans that had been confirmed by laboratory diagnosis were reported to the FOPH in 2014 (previous year: 7,479), corresponding to a reporting rate of 93 new infections per 100,000 inhabitants (previous year: 91 per 100,000). The number of reported cases thus remained high but stable compared with the previous year. The number of cases has been rising steadily since 2005 and in 2012 reached its highest level to date since the reporting obligation was introduced, with over 100 reported infections per 100,000 inhabitants (**Figure 9.a**).
As in previous years, the age group with the highest reported rate was young adults aged 15–24, with 137 cases per 100,000. It has also been noticed that the reported rate in people aged over 65 has more

than doubled in the last 20 years (1994: 32 cases per 100,000; 2014: 103 per 100,000), while the reported rate in children under 5 years of age has tended to decrease during the same period (from 130 to 98 cases per 100,000). Slightly more men than women were affected (4,002 cases versus 3,507 cases). The peak winter figure in January 2014 was much higher than in previous years, at 910 infections. The peak summer figure in August 2014 of 957 reported infections was similar to previous years. The most commonly identified species in 2014 remained *C. jejuni* at 75%, although in 15% of cases it was not possible to distinguish between *C. jejuni* and *C. coli*.

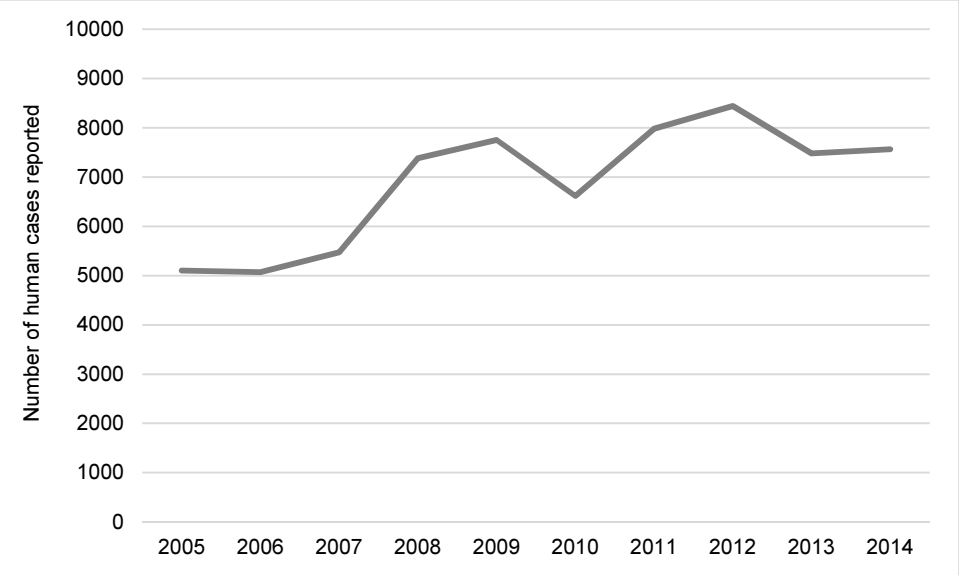


Figure 9.a: Number of cases of campylobacteriosis reported in humans, 2005–2014
(Source: Federal Office of Public Health, as at March 2015)

9.1.2 Obligation to report to the authorities and monitoring in animals

Campylobacteriosis in animals must be reported to the authorities and is among the epizootics that must be monitored (TSV, Art. 5). *Campylobacter* infections do not have to be reported to the authorities.

Campylobacteriosis
Campylobacteriosis is monitored passively. In 2014, 164 cases of campylobacteriosis were reported in animals. The number of reports doubled compared with the previous year and was several times as high as in the years before that. In the last 10 years (2005–2014), the number of cases has fluctuated between 5 and 164 per year. Dogs were most frequently affected (71%), followed by cattle (13%) and cats (12%) (**Figure 9.b**). As campylobacteriosis tests were no longer carried out in recognised diagnostic laboratories, this can be ruled out as the reason for the increase in cases. However, more confirmation tests were carried out in the reference laboratory in 2013 and 2014. The higher number of confirmed positive results could have altered reporting behaviour in cantonal veterinary offices. A genuine increase in cases cannot be ruled out.

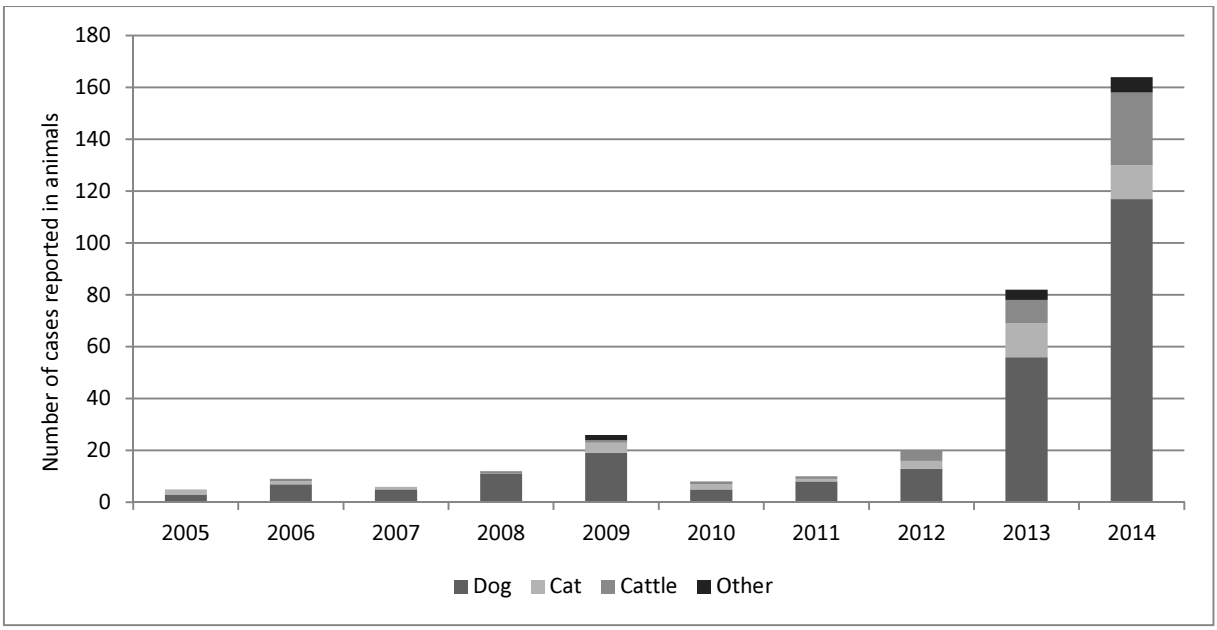


Figure 9.b: Number of cases of campylobacteriosis reported in animals, 2005–2014
(Source: Information system for reporting epidemics (InfoSM), FSVO; as at February 2015)

Campylobacter infections

Campylobacter infections are actively monitored, as the animals are healthy here and there are no signs of illness. In slaughterhouses, cloacal/faecal swabs and appendixes are examined for *Campylobacter*. As poultry plays a particularly significant role as a source of infection for humans, poultry flocks have been monitored since 2002. In 2014, 179 out of 493 (36%) broiler chicken flocks were *Campylobacter*-positive (*C. jejuni* (163) and *C. coli* (16)). Since 2009, the prevalence among broiler chicken flocks examined by means of a cloacal swab has been between 33% and 38%. The *Campylobacter* burden is particularly high during the summer months (**Figure 9.c**).

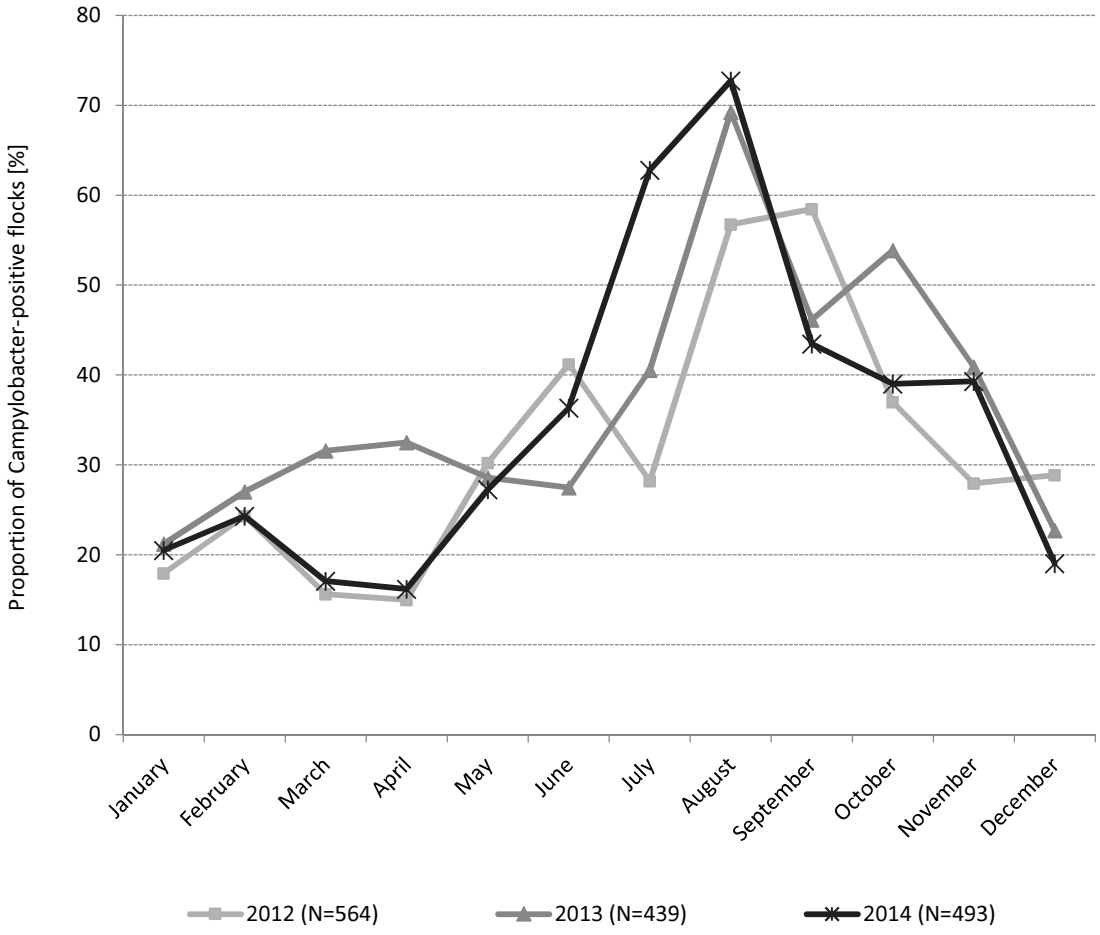


Figure 9.c: Comparison of *Campylobacter* prevalence (stated in percent) in broiler chicken flocks per month, 2012–2014

9.1.3 *Campylobacter* monitoring in food

Due to cross-contamination at the slaughterhouse, poultry meat from flocks that were originally *Campylobacter*-negative can also be contaminated with the pathogen by the end of the slaughtering process. Poultry carcasses and poultry meat are monitored by the poultry industry. As part of the poultry industry's self-regulation activities, 1,554 examinations were carried out in 2014, of which 296 (19%) proved to be *Campylobacter*-positive (*C. jejuni* (48), *C. coli* (5) and not classified (243)). In the last 4 years, the proportion of positive samples among the approximately 1,300 poultry meat samples inspected per year was between 29% and 37%. Levels were particularly high in fresh chicken meat, with up to 50% of samples found to be positive. Up to 70% of poultry carcasses were *Campylobacter*-positive in 2008, according to a study. Inspections of poultry meat from the retail trade in 2007 and 2009/10 found *Campylobacter* in 44% and 38% of raw meat samples respectively.

9.1.4 Measures

No direct action is taken for campylobacteriosis or *Campylobacter* infections in animals. If animals for slaughter are affected, the ordinance on primary production stipulates that foods must be produced that

are not harmful to human health. Since 1 January 2014, poultry liver from a *Campylobacter*-positive flock may be sold on the market only if it is frozen (hygiene ordinance, Art. 33a). This significantly reduces the bioburden in poultry livers. Furthermore, the packaging of fresh poultry meat and any preparations containing it must display hygiene advice, stating that the products must be thoroughly heated through before consumption and advising how consumers should handle fresh poultry meat hygienically in the home. The note on heating meat through completely before consumption must also be included on the packaging of minced meat, meat products made from poultry and meat preparations (particularly those including mechanically separated meat) (ordinance on food of animal origin, Art. 9).

9.1.5 Assessment of the situation

At present, about 1 in 1,000 people suffer from campylobacteriosis every year. As many infected people do not go to the doctor and stool samples are not always examined, the actual number of cases is 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 could be traced back to chickens (Kittl *et al.*, 2013). The focus is on poultry meat as a source of infection. Occurrence in broiler chicken flocks has stagnated at a high level for years, with clear peaks during the summer months. Meat from other animal species is not considered to be a significant source of infection, as *Campylobacter* does not usually survive on the surface of the carcasses of these animals. In the study mentioned above (Kittl *et al.*, 2013), 19% of cases were attributable to cattle and 1% to pigs. The high numbers of cases in humans in the summer could be due to an increased burden in poultry flocks, an increase in the number of barbecues or increased travel abroad. The Swiss Tropical and Public Health Institute (Swiss TPH) published a study in 2014 that identifies the main cause of the peak in winter (Bless *et al.*, 2014). This study investigated cases of sickness reported between December 2012 and February 2013. It found that consuming 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% had to have inpatient treatment in a hospital.
If consumers adhere to the rules on kitchen hygiene (see also hygiene rules when handling food), 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 plates for raw meat and food that is ready to eat. Good kitchen hygiene should generally be observed when preparing fresh chicken, and raw meat (or marinated raw meat for barbecues) should not be allowed to come into contact with ready-to-eat foods (such as side dishes and salad).
Direct contact with dogs plays only a minor role in *Campylobacter* infections. The proportion of human strains that could be traced back to dogs in the study came to 9% (Kittl *et al.*, 2013).

9.1.6 The *Campylobacter* platform

At the end of 2008, representatives of the authorities, researchers and the poultry industry came together to set up the *Campylobacter* platform, with the aim of helping to contain this cause of diarrhoeal diseases by exchanging knowledge, coordinating measures and initiating research projects. The focus is on reducing the burden at poultry farms and contamination of carcasses at slaughterhouses, as well as on communicating the most important rules of kitchen hygiene. The FSVO plans to inform the public about risks linked to handling meat in a joint broad-based communication campaign and to communicate how to handle food hygienically in the home. The industry has been invited to get involved and to make available its communication channels and media products. It is considered important to have joint communication with clear, recognisable messages, to improve effectiveness. When the hygiene ordinance (HyV) is next amended, there are plans to introduce a process hygiene criterion for *Campylobacter* for poultry carcasses that have been refrigerated.

9.2 Salmonellosis/*Salmonella* infections

Salmonellosis is caused by an infection with bacteria of the *Salmonella* species. People generally become infected by consuming contaminated foods such as eggs, egg dishes, non-pasteurised milk or meat and meat products. However, it is also possible in principle to become sick through direct contact with animals infected with *Salmonella* or through human-to-human transmission. A *Salmonella* infection usually causes diarrhoea, which starts suddenly, as well as nausea, vomiting, fever, headache and abdominal pain. The symptoms can last for several days. As *Salmonella* multiply in food at room temperature, perishable foods should always be stored in a cool place. Meat dishes must be cooked through. Egg dishes that are not heated (e.g. mayonnaise, tiramisu, chocolate mousse) should always be eaten on the day they are prepared. In general, good kitchen hygiene (see hygiene rules when handling food) is important.
All animal species can contract salmonellosis. The symptoms range from fever, diarrhoea and impaired performance to abortions or weak newborns. The clinical symptoms often vary depending on the species and the age of the animals. Along with contaminated feed and water, animals with a latent infection represent the most common source of infection for other animals. Rodents (particularly mice) can also transmit the pathogen. To keep animal populations as free from *Salmonella* as possible, attention should be paid to the levels of hygiene in their stalls. However, animals are often merely carriers of *Salmonella* without becoming sick themselves (asymptomatic *Salmonella* infection). This puts humans at risk, as they can become infected by consuming contaminated foods that have come from such infected animals.

9.2.1 Obligation to report to the authorities and numbers of cases in humans

Diagnostic laboratories must report evidence of *Salmonella* in humans. If there is a cluster of cases at a particular time and in a particular place (e.g. with food poisoning), doctors also have a duty to report this (ordinance of the FDHA on doctor and laboratory reports). A total of 1,238 cases of salmonellosis that were confirmed by laboratory diagnosis were forwarded in 2014 (previous year: 1,266 cases). This corresponds to a reported rate of 15 new infections per 100,000 inhabitants. Case numbers have stagnated at this level since 2009. No further decline is discernible (**Figure 9.d**). As in previous years, the age group with the highest reported rate was children under 5 years of age (< 1 year: 45 per 100,000; 1- to 4-year-olds: 47 per 100,000). The typical seasonal increase in reports during the summer and autumn months was noticed once again in 2014. The most commonly reported serovars remained *S. enteritidis* (28%), followed by the monophasic strain 4,12,:i:- (16%) and *S. typhimurium* (15%). An outbreak of *S. bovismorbificans* (N = 25) was also observed in 2014, which was caused in particular by consumption of sprouts in southern Germany. In 80% of cases, patients said that they had eaten in a restaurant in southern Germany.

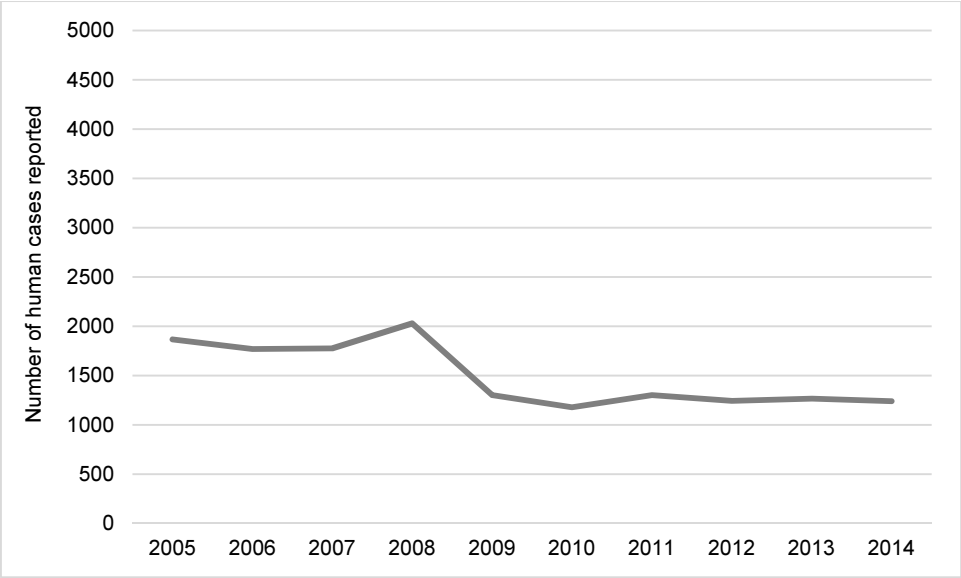


Figure 9.d: Number of cases of salmonellosis reported in humans, 2005–2014 (Source: Federal Office of Public Health, as at March 2015)

9.2.2 Obligation to report to the authorities and monitoring in animals

In animals, illness caused by *Salmonella* (salmonellosis) in all species and infections with *Salmonella* in poultry and pigs (healthy carriers) must be reported to the authorities and belong to the group of epizootics that must be combated (TSV, Art. 4, Art. 222–227 and Art. 255–261). Anyone who keeps or cares for animals must report any suspicious cases to their veterinarian.

Salmonellosis in animals

Salmonellosis is passively monitored. A total of 63 cases of salmonellosis were reported in animals in 2014. These mainly affected cows (22), reptiles (17) and dogs/cats (12). This is within the range of annual fluctuations, including for cattle. Slightly more cases were reported in cattle in 2013 than in previous years (**Figure 9.e**). *S. typhimurium* and the monophasic variant 4,12:i:- are often detected in cattle. In the last 10 years (2005–2014), between 49 and 83 cases of salmonellosis have been recorded per year in animals (32% cattle, 31% reptiles, 20% dogs/cats and 6% sheep).

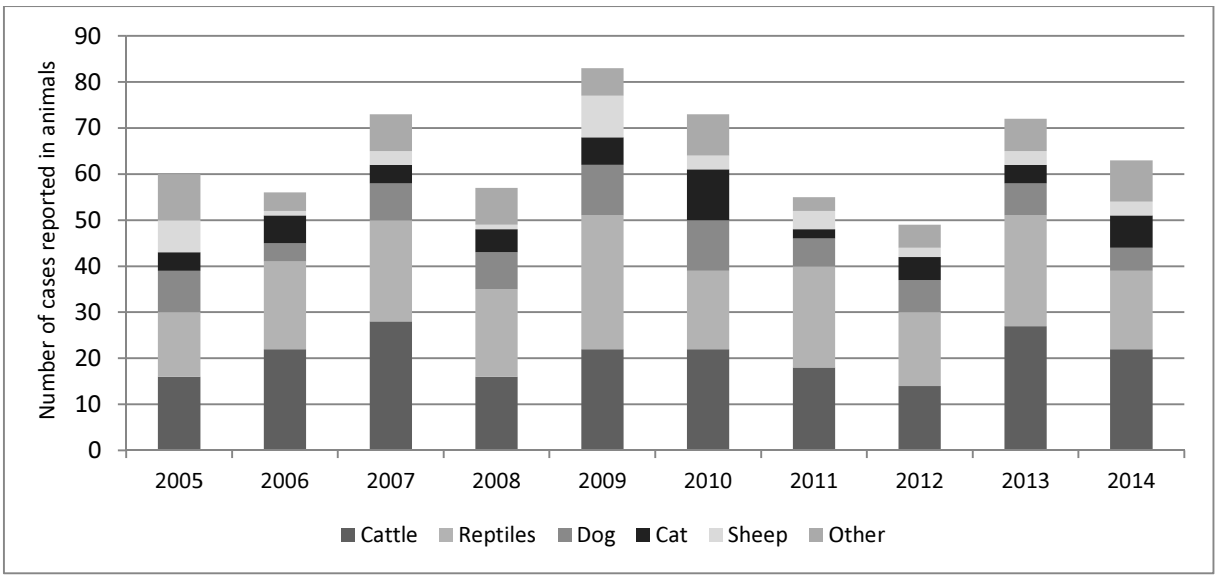


Figure 9.e: Number of cases of salmonellosis reported in animals, 2005–2014
(Source: Information system for reporting epidemics (InfoSM), FSVO; as at February 2015)

Salmonella infections in poultry and pigs

Salmonella infections in poultry are actively monitored. Since 2007, *Salmonella* infections in poultry have been monitored through a comprehensive control programme. Poultry holdings with more than 250 breeding animals, 1,000 laying hens, 5,000 broiler chickens or 500 turkeys must be inspected regularly for *Salmonella* (in accordance with the technical instructions on the taking and examination of samples for *Salmonella* infections in domestic poultry). The *Salmonella* serotypes *S. enteritidis*, *S. typhimurium* and its monophasic variant 4,12:i:- are combated, as well as *S. hadar*, *S. infantis* and *S. virchow* in breeding animals.

5 cases were reported in poultry in 2014 as part of the control programme, 1 case in laying hens at a holding with space for > 1,000 animals (*S. enteritidis*) and 4 cases in broiler chickens at holdings with space for > 5,000 animals (all *S. enteritidis*). The latter all occurred within the same period. The affected companies had all obtained their day-old chicks from the same breeder. Regular inspections at this breeder's premises had consistently shown negative results. *The affected hatching eggs originally came from the EU.* Transovarial transmission cannot be ruled out in the case of *S. enteritidis*. No further investigations have been carried out. There were also 8 suspected cases (positive environmental samples that were not confirmed in animals). **Table 9.a** shows which categories of animals other types of *Salmonella* were detected in.

Since 2007, no more than 11 *Salmonella* infections per year in poultry have been reported in the information system for reporting epidemics (InfoSM). These generally affected laying hens. In broiler chickens, only one case in 2010 and the 4 linked cases (probably an outbreak) in 2014 have been found to date. In breeding flocks, there has so far been one case in 2012.

Category of animals and size of company	Incident	Number of incidents	Serovar	Number of serovars
Laying hens > 1,000 spaces	Epidemic	1	*S. enteritidis*	1
	Suspected case	6	*S. enteritidis*	4
			S. typhimurium	2
	–	4	*S. mbandaka*	2
			S. idikan	1
			S. schwarzengrund	1
Broiler chicken > 5,000 spaces	Epidemic	4	*S. enteritidis*	4
	Suspected case	2	*S. enteritidis*	1
			S. typhimurium	1
	–	16	*S. albany*	4
			S. schwarzengrund	2
			S. braenderup	1
			S. bredeney	1
			S. chester	1
			S. idikan	1
			S. infantis	1
			S. lexington	1
			S. senftenberg	1
			S. tennessee	1
			S. welikade	1
			[13,23:i:- (monophasic)]	1
Broiler turkeys > 500 spaces	–	2	*S. indiana*	1
			Salmonella, not classified	1
Small flocks of laying hens, outside the control programme	–	6	*S. typhimurium*	3
			S. enteritidis	1
			S. indiana	1
			Salmonella, not classified	1

Table 9.a: *Salmonella* cases detected in 2014

Salmonella infections in pigs must be reported to the authorities, but there is to date no government control programme. However, the ordinance on primary production stipulates that foods must be produced that are not harmful to human health.
Basic studies carried out between 2006 and 2008 showed the following estimated prevalence of *Salmonella* infections in poultry and pigs: in laying hens 1.3% (3 out of 235 flocks; 2006), in broiler chickens 0.3% (1 out of 299 flocks; 2007), in slaughtered pigs 2.3% (14 out of 615 slaughtered pigs; 2007) and in breeding pigs 13.0% (29 out of 223 breeding pig companies; 2008). While *S. enteritidis* and *S. typhimurium* were the only serovars found in poultry, they accounted for 60% of serovars detected in slaughtered pigs and 27% of those detected in breeding pigs.

9.2.3 *Salmonella* monitoring in food

Monitoring in meat

Poultry meat and meat from other livestock (particularly pigs) can be contaminated with *Salmonella*. The poultry industry monitors its production as part of its self-regulation. Only Swiss poultry meat is included in the analysis. In 2014, 6 out of 3,268 (0.2%) samples were *Salmonella*-positive (*S. infantis* (1), *S. mbandaka* (2), *S. agona* (1), *Salmonella*, not classified (2)). The positive samples involved skin from the neck (2), fresh chicken meat with skin (2), poultry meat preparations (1) and mechanically separated meat (1). The 0.2% represents the lowest figure for annual fluctuations over the last 5 years, which range from 0.2% to 2% of approximately 3,000 samples examined each year.

Studies have shown that in 2007, 0.4% of Swiss broiler chicken meat available for sale and 15.3% of broiler chicken meat imported from abroad was *Salmonella*-positive, compared with 2.6% of poultry carcasses in 2008.

Monitoring in dairy products

In 2014, the Institute of Food Science (IFS) at Agroscope examined Swiss cheeses made from raw milk or milk heated to only a low temperature for various pathogens. All 222 samples were *Salmonella*-negative. Between 2002 and 2009, dairy products were monitored regularly for *Salmonella* as part of the national inspection programme for dairy products. As *Salmonella* had never been found since 2004, examination for *Salmonella* as part of this programme was stopped in 2009.

Monitoring at the border

Only a few products from third countries enter Switzerland directly via airports. As part of a border control programme, a small sample is taken every year and examined for certain infectious agents, among other things. In 2014, 14 samples of raw fish and 2 samples of ready-to-eat fish products from Vietnam, Malaysia, Japan and Australia, as well as 29 samples of fresh beef from South America, the USA, Canada, Australia and New Zealand, tested negative for *Salmonella* (see also the annual report of the border veterinary service for 2014).

9.2.4 Measures

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 company must be blocked so that no movement of animals is possible (TSV, Art. 69). Healthy animals may be slaughtered, but a note regarding salmonellosis must be included on the accompanying documentation. Milk from dairy cows with salmonellosis may be used only as animal feed and only if it has previously been boiled or pasteurised.

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 infections in poultry and pigs

If one of the serovars that is relevant according to the law on epizootics is detected in the environment of poultry flocks, this is a suspected case. If *Salmonella* is detected in the organs/muscles of 20 animals in a herd or flock, this is an epidemic. The company is blocked, to prevent the movement of animals (TSV, Art. 69). The infected herd or flock must be slaughtered or killed. The poultry meat and eggs from such a flock may be used only if they have previously undergone heat treatment to destroy the *Salmonella*. The block on the company can be lifted only 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*.

Meat from infected pigs may also be marketed only if it has undergone heat treatment to destroy the *Salmonella*.

Evidence of *Salmonella* in food

The hygiene ordinance stipulates limits for *Salmonella* in various foods. If these are exceeded, canton chemists must report this to the FSVO. The foods concerned will be 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 in principle contain a note stating explicitly that these products must be heated through thoroughly before consumption (ordinance on food of animal origin, Art. 9).

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

9.2.5 Assessment of the situation

The decline in the number of cases in humans from over 6,000 cases per year in the early 1990s to the current level of about 1,300 cases per year has largely been attributed to the control programme for *S. enteritidis* in breeding and laying hens that was introduced in 1995. The number of cases of *S. enteritidis* in laying hens and breeding animals declined from 30 in 1996 to 3 in 2006. The control programme was extended in 2007 to include broiler chickens and turkeys as well as other serovars, although it is limited to larger companies. In addition to *S. enteritidis*, *S. typhimurium* (incl. the monophasic variant) is also controlled by the state, as well as *S. hadar*, *S. infantis* and *S. virchow* in breeding flocks. Since 2007, no more than 11 cases have been reported per year in poultry in the information system for reporting epidemics (InfoSM). These case numbers include smaller companies and other serovars that are not covered by the control programme.

It is not entirely clear how much of an influence pork and beef have as a reservoir for human cases. In order to further reduce the number of human cases, which is currently stagnating, it may be necessary to extend the control programme to these species. The same applies as with *Campylobacter*: good kitchen hygiene is important to prevent cases of salmonellosis in humans.

9.3 Listeriosis

Listeriosis is caused by an infection with bacteria of the *Listeria* species. *Listeria* occur everywhere in the environment, can survive in the soil and in plants for weeks or months and use a wide range of hosts. Humans become infected through direct contact with sick animals or abortion material or by eating contaminated foods. Listeriosis can manifest itself in many different ways and ranges from listeriosis in pregnancy to glandular, local or septic/typhoid listeriosis or listeriosis of the central nervous system. It is important to ensure good hygiene and to avoid dirt and smear infections when handling animals. In particular, pregnant women and immunocompromised people should avoid raw meat, raw sausage products, smoked cheese and soft cheese made from non-pasteurised milk.

The animals that most commonly become infected with *Listeria* are cattle, sheep and goats, although in principle any species can be affected. Silage feeding is a known risk factor for an infection. If silage is not adequately acidified, *Listeria* can multiply in it easily. As well as asymptomatic infections (healthy animals excrete *Listeria* in their faeces), various symptoms can occur in animals: fever, movement disorders, paralysis, conjunctivitis (cerebral form), septicaemia (septicaemic form) and abortions, premature births or birth of weak newborns (metrogenic form). This can be prevented with good feeding hygiene and clean silage.

9.3.1 Obligation to report to the authorities and numbers of cases in humans

Laboratory evidence of *Listeria monocytogenes* in humans must be reported to the authorities. If there is a cluster of cases at a particular time and in a particular place (e.g. with food poisoning), doctors must also report this (ordinance of the FDHA on doctor and laboratory reports).

A total of 98 cases of listeriosis that had been confirmed by laboratory diagnosis were reported to the FOPH in 2014, corresponding to a reporting rate of 1.2 new infections per 100,000 inhabitants. The number of reported cases was much lower in the 10 preceding years (2004–2013), at 39 to 73 per year (**Figure 9.f**). The increase compared with previous years was due to an outbreak in the period from October 2013 to April 2014, with 32 cases of serotype 4b. Pre-packaged, ready-to-eat salad was identified as the probable source of infection.

As in previous years, the highest rate was reported in people over 65 years of age, with 4.3 cases per 100,000 inhabitants. Two cases involved newborn babies; in these cases, the infection was probably transmitted from mother to child. The gender ratio was balanced, with 48 men and 50 women. The most commonly detected serotypes, as previously, were 1/2a (26%) and 4b (60%), with a significant increase in serotype 4b compared with the previous year, due to the outbreak.

Other outbreaks of listeriosis occurred in 2011 (serotype 1/2a; imported cooked ham) and 2005 (serotype 1/2a; contaminated cheese) and in the 1980s (serotype 4b). The latter involved contaminated Vacherin Mont d'Or cheese and led to the largest outbreak of *Listeria* to date in Switzerland, in which 122 people became ill and 33 died.

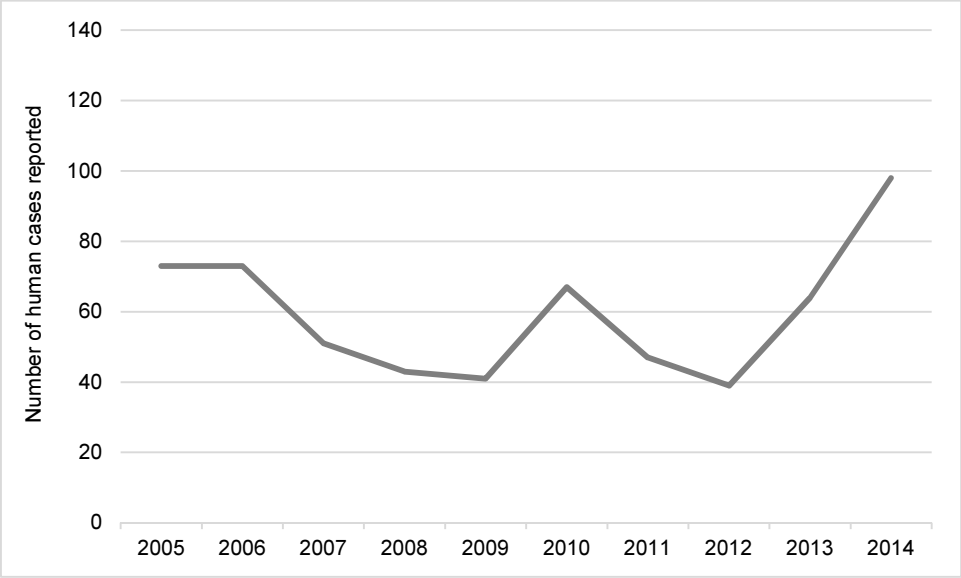


Figure 9.f: Number of cases of listeriosis reported in humans, 2005–2014
(Source: Federal Office of Public Health, as at March 2015)

9.3.2 Obligation to report to the authorities and monitoring in animals

Listeriosis in animals must be reported to the authorities and is among the epizootics that must be monitored (TSV, Art. 5). It is passively monitored. 8 cases of listeriosis were reported in ruminants in 2014 (5 cattle, 2 goats and 1 sheep). The ninth case in 2014 involved a monkey. In the last 10 years (2005–2014), the number of cases reported has fluctuated between 6 and 20 per year. Sheep were most frequently affected (39%), followed by cattle (36%) and goats (23%) (**Figure 9.g**).

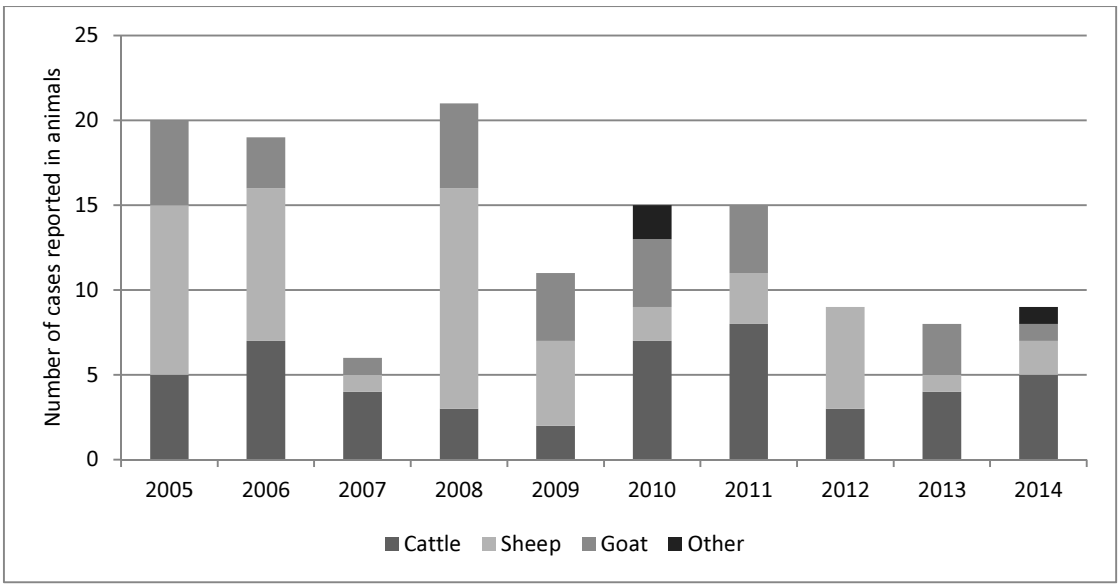


Figure 9.g: Number of cases of listeriosis reported in animals, 2005–2014
(Source: Information system for reporting epidemics (InfoSM), FSVO; as at February 2015)

9.3.3 *Listeria* monitoring in food

Monitoring in dairy products

A total of 2,345 samples were tested as part of the *Listeria* Monitoring Programme (LMP) of the Institute of Food Science (IFS) at Agroscope in 2014. Evidence of *Listeria (L.) monocytogenes* was found in 3 samples (0.2%). These included one environmental sample and the surface of a sample of semi-hard cheese and a sample of hard cheese. Types of *Listeria* other than *L. monocytogenes* were detected in 51 samples (2%). The LMP has been running since 2007 and examines 2,800–5,200 samples every year. *L. monocytogenes* has consistently been detected in fewer than 1% of samples, usually in environmental samples. When samples of cheese were involved, *L. monocytogenes* was only ever found on the surface of the cheese.

In one study carried out at the IFS in 2014, 222 samples of Swiss cheeses made from raw milk or milk heated to only a low temperature also tested negative for *Listeria*.

A national inspection programme for dairy products was carried out between 2002 and 2011, in which several hundred samples of semi-hard and soft cheese were tested every year. Evidence of *Listeria* was found in only very few samples of semi-hard and soft cheese each time, so the programme was stopped in 2011.

Monitoring at the border

Only a few products from third countries enter Switzerland directly via airports. As part of a border control programme, a small sample is taken every year and examined for certain infectious agents, among other things. In 2014, 16 samples of raw fish and 3 fish products (one of which was ready to eat) from Vietnam, Malaysia, Japan, Sri Lanka and Australia tested negative for *L. monocytogenes* (see also the annual report of the border veterinary service for 2014).

9.3.4 Measures

The hygiene ordinance stipulates limits for *Listeria* in various foods. If these are exceeded, canton chemists must report this to the FSVO. The foods concerned will be 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 in principle contain a note stating explicitly that these products must be heated through thoroughly before consumption (ordinance on food of animal origin, Art. 9). All large cheese manufacturers have a hygiene management system that complies with ISO 9000.

9.3.5 Assessment of the situation

Infections with *L. monocytogenes* frequently lead to sickness in humans. Even if the number of cases is low, mortality is high, particularly in older people. To prevent infections with *Listeria*, it is particularly important to monitor *Listeria* at different stages of the food chain. Milk and dairy products are monitored particularly carefully, because of the large outbreak in the 1980s. *Listeria* levels in the milk industry have remained stable and at a low level for years. The same applies to the situation with regard to animals.

9.4 Verotoxin-producing *Escherichia coli* (VTEC)

Verotoxin-producing *Escherichia (E.) coli* (VTEC) are a type of bacteria that are a major infectious agent associated with food. As they have a low minimum infectious dose, VTEC infections can easily occur through contaminated foods (e.g. minced beef that has not been heated sufficiently, unpasteurised dairy products or sprouts) or water that is contaminated by faeces. VTEC can also be transmitted from human to human. VTEC infections can be asymptomatic. Sickness usually begins with watery diarrhoea, which does not contain blood. Haemorrhagic colitis with bloody diarrhoea and abdominal cramps may develop later. Fever and vomiting are additional symptoms that can occur. Haemolytic-uraemic syndrome (HUS) can occur in 5–10% of symptomatic cases; this can become life-threatening in children of pre-school age in particular, with haemolytic anaemia, thrombocytopenia and kidney failure. The best preventative measures involve good kitchen hygiene and the heating of critical foods.
In warm-blooded animals, *E. coli* bacteria are part of the normal intestinal flora and do not cause illness. Among livestock, ruminants, particularly sheep and goats, are an important reservoir of VTEC agents.

9.4.1 Obligation to report to the authorities and numbers of cases in humans

Laboratory evidence of VTEC in humans must be reported to the authorities, and an additional report must be filled in by the doctor providing treatment. If there is a cluster of cases at a particular time and in a particular place (e.g. with food poisoning), laboratories and doctors must report this (ordinance of the FDHA on doctor and laboratory reports).
A total of 122 cases of VTEC that had been confirmed by laboratory diagnosis were reported in 2014 (previous year: 81 cases), corresponding to a reporting rate of 1.5 new infections per 100,000 inhabitants (previous year: 1.0 per 100,000). This is a significant increase compared with previous years and is one of the highest reported rates since the obligation to report to the authorities was introduced in 1999. In the last 10 years (2005–2014), the number of cases of VTEC has fluctuated between 34 and 122 per year (**Figure 9.h**). The age group with the highest reported rate continues to be children under 5 years of age, with 6.5 cases per 100,000 inhabitants; however, this has remained stable over the years, while the reported rates in adults have increased slightly in general. Slightly more women (N = 68) were affected than men (N = 54). No localised clusters have been observed. Of the 10 reported cases of HUS, 4 children aged between 0 and 4 years, 4 children aged between 5 and 14 years and 2 people aged over 65 were affected.
The increase observed in the number of cases is explained in particular by the fact that more multiplex plates are being used in laboratories, which is resulting in increased evidence of toxins. The fact that the number of cases of HUS has remained virtually constant supports this hypothesis.

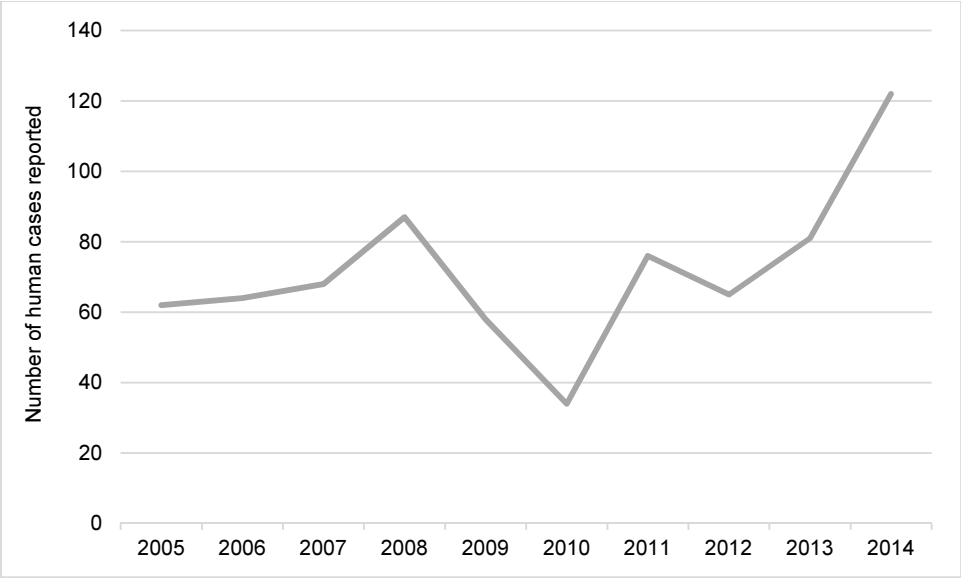


Figure 9.h: Number of cases of VTEC reported in humans, 2005–2014
(Source: Federal Office of Public Health, as at March 2015)

9.4.2 Obligation to report to the authorities and monitoring in animals

There is no obligation to report cases in animals to the authorities, as no cases of sickness occur. However, various studies have recorded data relating to the occurrence of VTEC.

Monitoring in livestock

VTEC is frequently detected in young cattle. In 2012, 417 out of 563 samples of faeces (74%) from young cattle at slaughterhouses tested positive for VTEC using PCR (42% O145, 26% O103, 24% O26, 8% O157 and 1% O111). In total, only 17 O26 strains, 28 O145 strains and 12 O157 strains were isolated. 9 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).

Samples of faeces from cattle, sheep and pigs were examined at slaughterhouses in 2000. 14% of faecal samples from cattle, 30% from sheep and 22% from pigs tested positive for VTEC. It was also demonstrated that younger cattle excrete more VTEC than older cattle. Caution is therefore necessary in applying such data to the entire cattle population. Most of the strains found in pigs were not very virulent.

Slaughtered rabbits were also examined for VTEC in 2008, and evidence of VTEC was found in 3% of faecal samples. Rabbits can thus also be a cause of contamination of carcasses
(Kohler *et al.*, 2008).

Monitoring in wild animals

239 samples of faeces from wild ruminants were analysed in 2011. 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, of which
44.6% had genes for the Vtx2 group, 30.4% genes for the Vtx1 group and 21.4% genes for both groups. The 56 VTEC strains came from red deer (18), roe deer (19), chamois (13) and ibexes (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 4 out of 153 wild boar (9%) using PCR. However, all the faecal samples taken from 73 wild boar were negative. Wild boar therefore appear to tend to be carriers of VTEC without excreting it (Wacheck *et al.*, 2010).

9.4.3 VTEC monitoring in food

Monitoring in dairy products

In a study carried out at the IFS in 2014, 222 samples of Swiss cheeses made from raw milk or milk heated to only a low temperature were tested for VTEC. 2 samples (0.9%) were PCR-positive for *vtx* genes. However, no isolates could be obtained for further classification.
During the national inspection programme for dairy products carried out between 2006 and 2008, VTEC was detected in 24 samples of semi-hard cheese and 5 samples of soft cheese, out of a total of 1,422 samples (2%). All of these samples involved non-O157 serotypes (13 isolates were classed as O2, O22 and O91). 9 isolates carried the *hlyA* gene, but all isolates tested negative for the *eae* gene.

Monitoring in foods of vegetable origin

Following an incident in 2011 in Germany in which people became infected with EHEC by consuming sprouts, 233 foods of vegetable origin (142 lettuces, 64 sliced fruits, 27 sprouts) were tested for VTEC in Switzerland in 2012. VTEC with a virulence profile of a low pathogenic strain was detected in one of the 233 samples.

Monitoring in meat

In the 1990s, 2.4% of minced meat samples and 21.6% of uncooked, frozen hamburgers tested positive for VTEC.

Monitoring at the border

Only a few products from third countries enter Switzerland directly via airports. Only small samples are therefore taken each year as part of a border control programme. In 2014, 29 samples of fresh beef from Brazil, Argentina, Chile, the USA, Canada, Australia and New Zealand tested negative for VTEC (see also the annual report of the border veterinary service for 2014).

9.4.4 Measures

The hygiene ordinance stipulates limits for *E. coli in various foods.* Specific limits are set for VTEC in sprouts. If these values are exceeded, canton chemists must report this to the FSVO. The foods concerned will be 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 contain a note stating that these products must be heated through thoroughly before consumption (ordinance on food of animal origin, Art. 9).

9.4.5 Assessment of the situation

The significance of VTEC infections is probably underestimated, as systematic tests are not carried out for VTEC when investigating the causes of diarrhoea. Because of the low infectious dose (< 100 microorganisms), infections with VTEC can occur very easily through contaminated food or water that is contaminated with faeces. The results of the characterisation of non-O157 VTEC patient strains from 2000–2009 showed considerable diversity in the genomes. This suggests that these infections occur sporadically in Switzerland and are not linked to bigger outbreaks (Käppeli *et al.*, 2011a). Even if O157:H7 is the main cause of HUS, O26:H11/H^- has become established as the most common non-O157 infectious agent for HUS. A study conducted in 2012, which examined 27 human strains from patients with bloody diarrhoea and 11 bovine strains and 1 ovine strain from healthy animals, showed that cattle and sheep can be a reservoir for O26:H11/H^- (Zweifel *et al.*, 2013).
Ruminants are an important reservoir for VTEC. 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 (low level or high level) of the milk and even after a maturing time of 16 weeks, VTEC must be taken into account as a risk with such products. Hygiene in slaughtering and milking is particularly important when producing foods of animal origin.
As well as foods of animal origin, however, the so-called "spinach outbreak" in the USA in 2006 and the outbreak in Germany in 2011 caused by sprouts contaminated with VTEC O104 show the potential importance of plant-based foods. To prevent such infections, it is important to stress general measures relating to kitchen hygiene such as washing foods of vegetable origin and the prevention of cross-contamination (e.g. the order in which foods must be processed: firstly foods that are ready to eat, then raw foods; cleaning of surfaces and hands in between).

9.5 Trichinellosis

Trichinellosis is caused by *Trichinella*, a threadworm. Depending on the infectious dose, the disease may be asymptomatic or fatal. Early symptoms include muscle pain, swelling of the upper eyelid, bleeding from the retina or under the conjunctiva and nails, eye pain and sensitivity to light. Fever, thirst, outbreaks of sweat, chills and a feeling of weakness may develop later. Humans become infected by consuming infected pork or wild boar meat, or more rarely horse meat, or meat products manufactured from these, that has not been heated or has not been heated sufficiently. Freezing the meat (-25°C for 10 days, for pieces of meat > 15 cm thick for 20 days) will kill off any *Trichinella* that are present. Heating to over 70°C will have the same effect.
In animals, carnivorous and omnivorous mammals such as pigs, wild boar, dogs, cats, foxes, martens and rodents are generally asymptomatic carriers. Domestic pigs become infected primarily by consuming rodents containing *Trichinella*, while wild boar can also become infected by eating infected fox carcasses. The feeding of raw or insufficiently heated slaughterhouse waste and food scraps can also be a method of transmission. However, this is currently prohibited in pigs. Horses can also be affected in rare cases. The cause of this is suspected to be accidental consumption of hay contaminated with infected rodents.

9.5.1 Obligation to report to the authorities and numbers of cases in humans

Evidence of *Trichinella (T.)* in humans that has been confirmed by laboratory diagnosis has had to be reported to the authorities again since 2009 (ordinance of the FDHA on doctor and laboratory reports). There were no reports of trichinellosis in people residing in Switzerland in 2014. Since the duty to report to the authorities was reintroduced in 2009, no more than 4 cases have been reported per year (**Figure 9.i**).

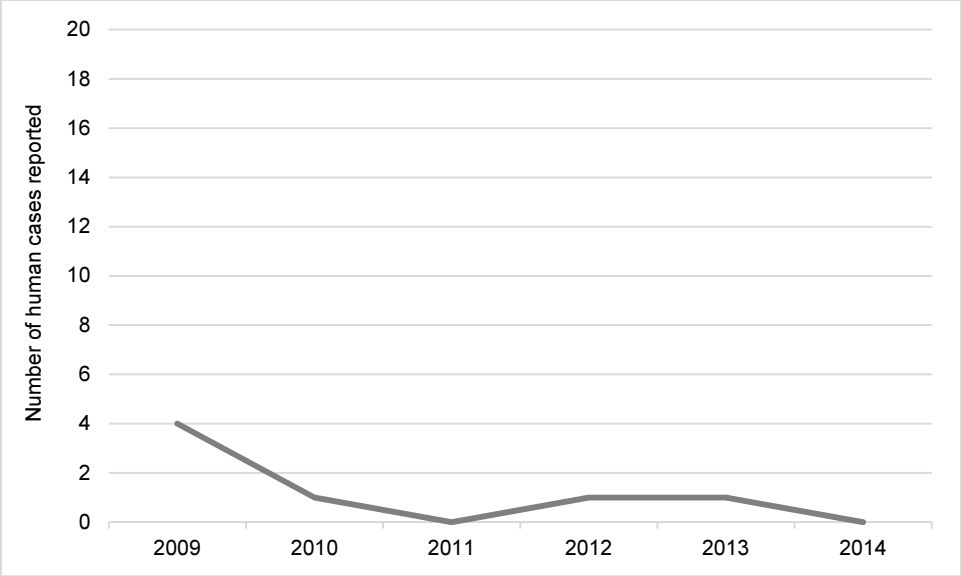


Figure 9.i: Number of cases of trichinellosis reported in humans, 2005–2014 (Source: Federal Office of Public Health, as at March 2015)

9.5.2 Obligation to report to the authorities and monitoring in animals

Trichinellosis must be reported to the authorities and is among the epizootics that must be monitored (TSV, Art. 5). It is monitored passively in animals. In 2014, 5 cases of trichinellosis were reported in lynxes. In the last 10 years (2004-2013), between 0 and 5 cases have been registered per year. All cases were observed in carnivorous wild animals (86% in lynxes, 10% in foxes and 5% in wolves, **Figure 9.j**). Evidence of *T. britovi* was found in each case.

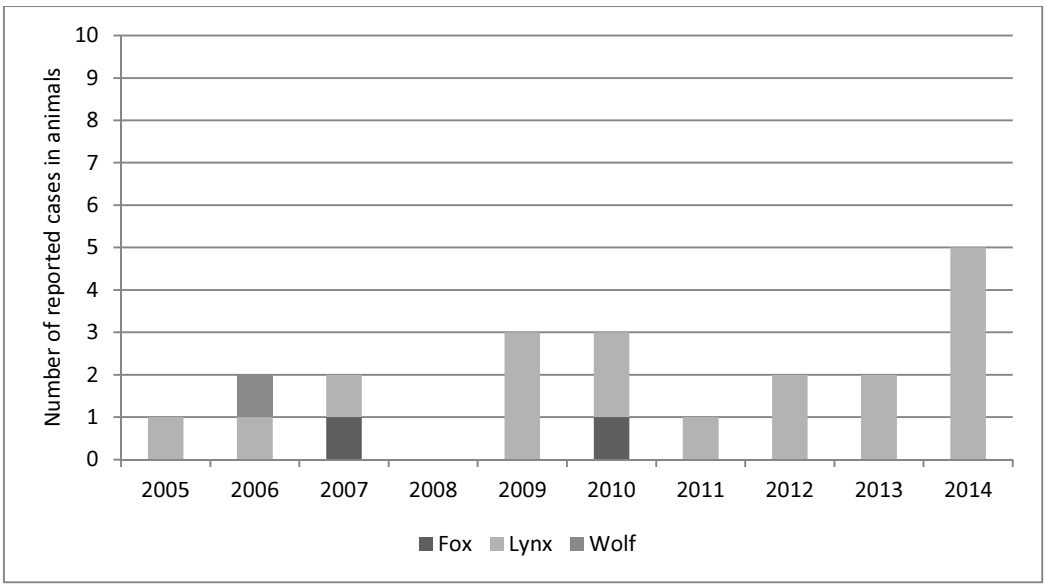


Figure 9.j: Number of cases of trichinellosis reported in animals, 2005–2014
(Source: Information system for reporting epidemics (InfoSM), FSVO; as at February 2015)

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 (Frey *et al.*, 2009a).
Wild boar were investigated a little more closely in 2008. Although no evidence of *Trichinella* was found in any of the 1,458 wild boar, 3 wild boar were found to have antibodies to *Trichinella* (seroprevalence 0.2%) (Frey *et al.*, 2009b).

9.5.3 *Trichinella* monitoring in food

All carcasses from animals in the horse family, domestic pigs, wild boar, bears and beavers must be examined for *Trichinella*. An exception is made for small companies that produce exclusively for the local market and have obtained permission for this from the relevant canton (ordinance on slaughter and meat inspection (VSFK), Art. 31). Meat that has been produced only for the local market must be labelled accordingly (ordinance on food of animal origin, Art. 9).
2.5 million slaughtered pigs tested negative for *Trichinella* using the artificial digestion method in 2014, corresponding to 93% of the entire population of slaughtered pigs. In horses, 2,492 horses or 84% of the entire population of slaughtered horses tested negative. No evidence of *Trichinella* was found in 1,713 wild boar.
The number of tests carried out was around the same as in previous years since 2010. No more than 490,000 pigs were tested between 2001 and 2004. The number of tests in slaughtered pigs increased steadily from 2005 onwards: 34% in 2005, 44% in 2006 and about 90% in 2007 to 2009. *Trichinella* was never found in pigs, horses or wild boar.

9.5.4 Measures

As this is an epizootic that must be monitored, no measures are generally taken with animals in the event of an epidemic. In slaughtered animals, the contaminated carcass would be destroyed in the event of positive evidence.

9.5.5 sAssessment 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 on animals slaughtered in Switzerland for many years and consistently shown negative results, it can be assumed that these animals are free from *Trichinella*. A *Trichinella* infection from Swiss pork is extremely unlikely.
The risk of transmission from wild animals to the conventional domestic pig population is classed as negligible. Nevertheless, it is important to monitor wild animals and pigs kept in fields. *T. britovi* occurs in lynxes, foxes and wolves in Switzerland. Wild boar have to date been negative; however, *Trichinella* infections cannot be ruled out in wild boar. The results of the study from 2008 show that wild boar can come into contact with *Trichinella*. It was also unclear whether it was a Swiss wild boar that was likely to have led to an infection in a Swiss citizen in 2012. The hunter and butcher had tried raw sausage dough containing wild boar meat. As only serological tests are generally carried out in humans, the exact species of *Trichinella* that was involved also remained unclear. This case highlights the fact that raw or insufficiently heated pork/meat should not be consumed.

9.6 Tuberculosis

Tuberculosis is caused by various types of mycobacteria, most commonly *Mycobacterium (M.) tuberculosis*. *M. bovis*, the classic agent that causes bovine tuberculosis, has for many years accounted for no more than 2% of cases of tuberculosis per year. Only about 10% of those infected become ill, usually within a few months but sometimes only after several decades. Tuberculosis manifests itself as pulmonary tuberculosis in around 80% of patients, although it can affect any organ. Patients usually have a cough, expectoration and possibly chest pain. Fever, weight loss, loss of appetite, night sweats and fatigue are also typical. Transmission occurs when a person suffering from pulmonary tuberculosis coughs up droplets containing bacteria, which are then inhaled by another person. These bacteria can persist in the body for decades without making the person ill.

9.6.1 Obligation to report to the authorities and numbers of cases in humans

Laboratories and doctors must report cases of tuberculosis in humans. An additional report is also necessary. If there is a cluster of cases at a particular time and in a particular place (e.g. with food poisoning), laboratories and doctors must also report this (ordinance of the FDHA on doctor and laboratory reports).
In 2014, 2 out of 477 cases of tuberculosis were caused by *M. bovis* (0.5%). These involved 2 young women aged between 15 and 17 from a migrant background. This was within the same range as in previous years, with the exception of 2011, when 13 cases were recorded (**Figure 9.k**). 418 of the 477 reported cases were confirmed by laboratory diagnosis (*M. tuberculosis* (338), *M. bovis* (2), *M. africanum* (6), *M. caprae* (1), *M. tuberculosis*-complex (71, not specified)).

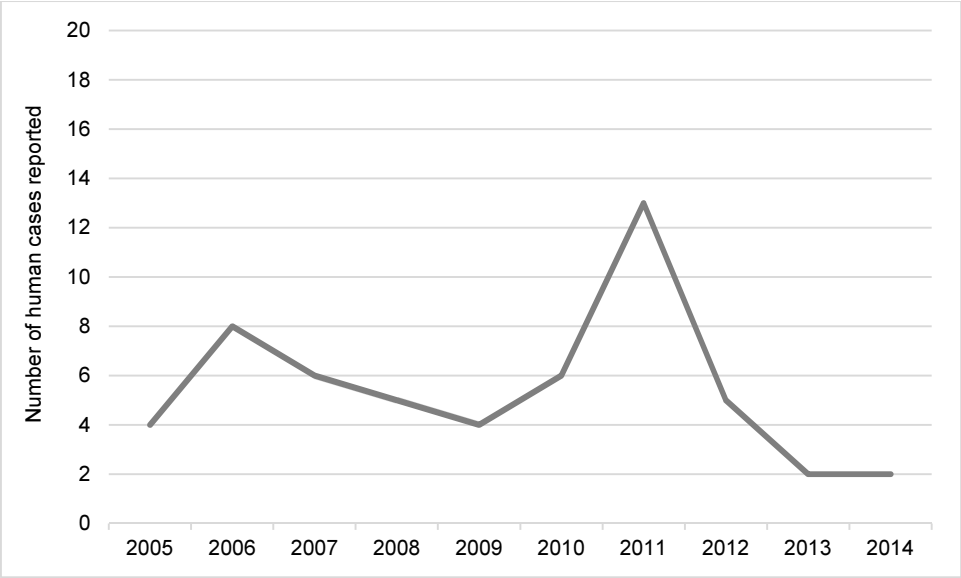


Figure 9.k: Number of cases of tuberculosis reported in humans, 2005–2014 (Source: Federal Office of Public Health, as at March 2015)

9.6.2 Obligation to report to the authorities and monitoring in animals

Tuberculosis in animals must be reported to the authorities and is among the epizootics that are to be eradicated (TSV, 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 to be free from tuberculosis in livestock. Proof of freedom from the disease was last provided in a study in 1997. In a random sample of 10% of companies (N = 4,874), a total of 111,394 cattle showed a negative result in a tuberculin skin test. However, isolated cases can occur. The last case in cattle before the current outbreak in 2013/14 occurred in 1998. In this case, a cow became infected due to reactivation of a human case of *M. bovis*.

2 cases of tuberculosis were reported in 2014, one in a cow and one in a cat (*M. microti*). This is similar to the figures for the years in which there were no specific incidents. The case involving a cow (*M. caprae*) was reported in early 2014 and was part of the outbreak that occurred in eastern Switzerland in 2013/14. In this outbreak, cattle became infected from wild animals during their alpine sojourn in Austria. As well as these cases in cattle, isolated cases have occurred in cats (3), parrots (1), dogs (1), horses (1) and llamas (1) in the last 10 years (2005–2014) (**Figure 9.l**).

Cattle have since then been monitored passively by investigating lesions resembling tuberculosis in the slaughterhouse. As few changes are to be expected in a country that is free from tuberculosis and the meat inspectors therefore have little training in how to recognise such cases, good monitoring is a challenge. The LyMON 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. In addition, lymphatic tissue with non-specific changes is to be sent regularly for examination. In 2014, 125 samples from cattle were sent in and tested using Ziehl-Neelsen staining and PCR. All 125 samples tested negative for the *M. tuberculosis* complex. Between October and December 2013, 20 samples tested negative.

Individual studies were also carried out:

a) In 1998, lymph nodes from deer were examined at the slaughterhouse for tuberculosis-like lesions and tested negative for *M. bovis* and *M. tuberculosis*. 124 out of 485 companies were inspected. All animals at these 124 companies were negative (Wyss *et al.*, 2000).
b) In 2010, 582 cattle that had been in the Austrian Alps in 2009 tested negative. 269 red deer from border regions were also negative. 6 out of 165 wild boar responded positively for the MTBC complex, but were negative for *M. bovis* and *M. caprae* (Schöning *et al.*, 2012).

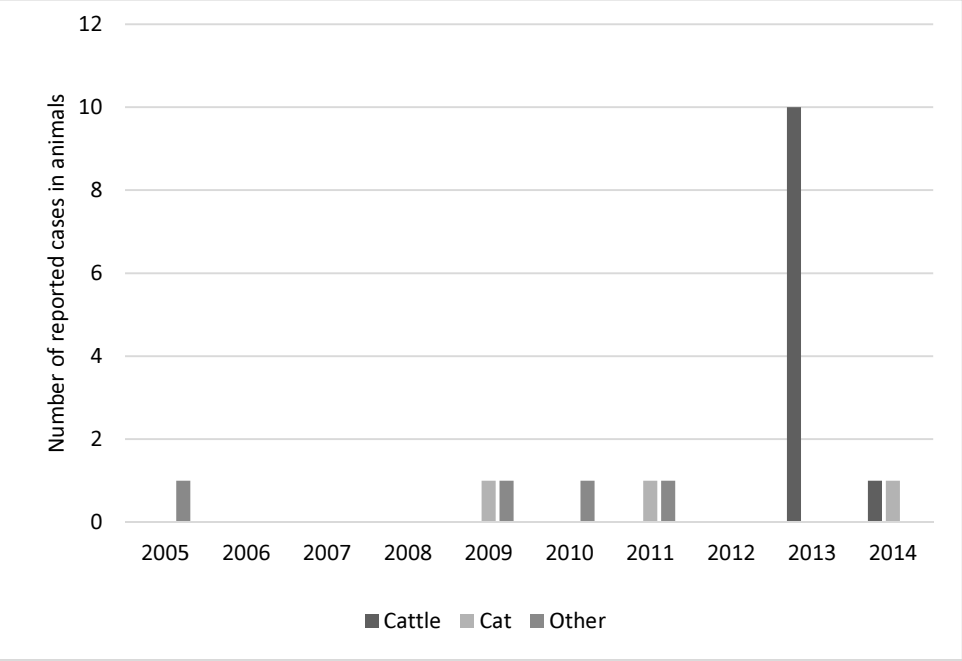


Figure 9.I: Number of cases of tuberculosis reported in animals, 2005–2014
(Source: Information system for reporting epidemics (InfoSM), FSVO; as at February 2015)

9.6.3 Measures

The measures that need to be taken in the event of infection of cattle with *M. bovis, M. caprae* and *M. tuberculosis* are regulated in the TSV, Art. 158–165. If there is a suspected epidemic or suspected contagion and in the event of an epidemic, the transportation of animals must be stopped at the company concerned and the herds must be epidemiologically investigated. In the event of an epidemic, all animals suspected to be infected at the company must be slaughtered and contaminated animals must be killed. The milk of contaminated animals or animals that are suspected to be infected must be disposed of. At most, it can be boiled and used as animal feed at the same company. Stables must be cleaned and disinfected. A year after an epidemic, all cattle at this company that are older than 6 weeks must undergo a follow-up inspection.

9.6.4 Assessment of the situation

Tuberculosis declined significantly in industrialised nations in the 20th century. Around 550 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 cases of tuberculosis involve immigrants. When people who are native to Switzerland are affected, they are usually 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. In the case of bovine tuberculosis transmitted to humans through food (alimentary), large numbers of germs are required (several million bacteria in adults). Only a few of the infected cows have lesions on their udders and release the pathogen into their milk. Often only a few individual animals are affected within a herd. Mixing their milk with milk that is not affected leads to dilution of the germs. Moreover, *M. bovis* cannot multiply in milk. 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. *M. bovis* is eliminated through pasteurisation or heat treatment at a high temperature (e.g. ultra-high temperature processing, UHT). When it is transmitted via the air (airborne), even a few pathogens can lead to an infection, which means that infections caused by droplets are possible through direct contact. As the majority of Swiss cattle are free from tuberculosis, direct transmission from cattle to humans is not likely. The main aim here is to protect cattle from becoming infected by people suffering from tuberculosis.

Risk factors for the import of tuberculosis include international trade, cattle spending their alpine sojourn in risk areas and wild animals in the area of the borders with Austria and Germany. The outbreaks in eastern Switzerland in 2013/14 show that a summer alpine sojourn in Tirol and Vorarlberg, where *M. caprae* is endemic in the red deer population, is a source of infection for Swiss cattle. The cause of the first outbreak of *M. bovis* in 2013 remained unclear. 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 required when importing cattle, particularly from countries with an increased number of cases.

9.7 Brucellosis

Brucellosis is caused by an infection with bacteria of the *Brucella* species. Humans become infected through direct contact with secretions from infected animals or animal materials (placentas, foetuses, laboratory material) or through consumption of contaminated, unpasteurised milk or dairy products made from this. The pathogen gets into the human body through the gastrointestinal tract, the mucous membranes of the conjunctiva, the respiratory tract or small skin injuries. Brucellosis can also be acquired in a laboratory. Transmission from human to human is very rare, but has been observed in babies who have acquired it through the milk of infected mothers. Women who are infected with brucellosis must therefore not breastfeed. Fever, night sweats, headache, loss of appetite, gastrointestinal symptoms, nausea and vomiting may occur. People who are exposed through their work should protect themselves against infections by using disposable gloves and a mask over their face and mouth.
Brucella can infect cattle, sheep, goats, bison, camels, alpacas, llamas, pigs, dogs, wild ruminants, foxes and horses. Brucellosis manifests itself 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 excrete the pathogen mainly through the sex organs and mammary glands.

9.7.1 Obligation to report to the authorities and numbers of cases in humans

Laboratories have an obligation to report brucellosis infections in humans (ordinance of the FDHA on doctor and laboratory reports).
A total of 3 cases of brucellosis that had been confirmed by laboratory diagnosis were reported to the FOPH in 2014 (previous year: 4 cases). These affected 1 man and 2 women aged between 46 and 63 years. 2 cases involved *B. melitensis,* while in 1 case the species was not determined. The number of human cases has been low for many years, and in the last ten years (2005–2014) has fluctuated between 1 and 14 cases per year (**Figure 9.m**).

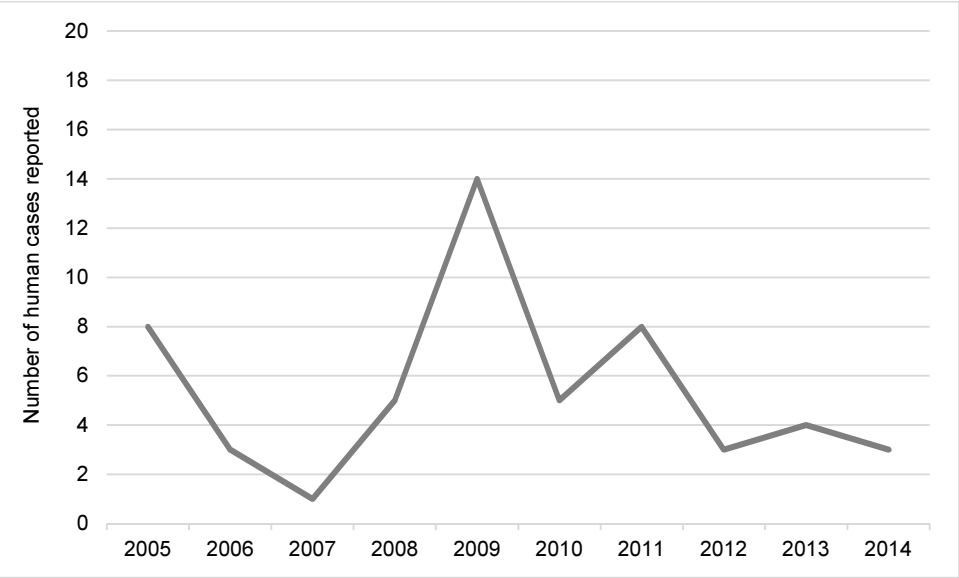


Figure 9.m: Number of cases of brucellosis reported in humans, 2005–2014
(Source: Federal Office of Public Health, as at March 2015)

9.7.2 Obligation to report to the authorities and monitoring in animals

Brucellosis must be reported in cattle, sheep and goats, pigs and rams. It is among the epizootics that must be eradicated (TSV, Art. 3 (cattle, sheep, goats, pigs) and combated (TSV, Art. 4 (rams)). Abortions in ungulates must also be reported to the authorities. If there is a cluster of abortions, these must be investigated (TSV, Art. 129). Vaccination against brucellosis is prohibited.
Switzerland is free from brucellosis in cattle, sheep and goats. The last case of *Brucella abortus* in cattle occurred in 1996, while the last case of *Brucella 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 companies underwent serological testing in 31,042 blood samples and 18,952 bulk tank 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 2014, 688 sheep farms (9,265 blood samples) and 471 goat farms (3,216 blood samples) tested negative for *Brucella melitensis*. For more information, see Chapter 6 "Freedom from disease".

No cases of brucellosis were reported in animals in 2014. 5 cases of brucellosis have been recorded in the last 10 years (2005–2014) (**Figure 9.n**). In the 3 pigs and the one wild boar, 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). In the period 2008–2010, 28.8% of 252 wild boar tested positive for *B. suis* biovar 2 using a culture/PCR and 35.8% showed antibodies (Wu *et al.*, 2011). At the first of the three companies at which there was an outbreak in 2009, Mangalitsa pigs that were kept outdoors were affected. Animals at the other 2 companies came into contact with animals at the first company. Investigations into the outbreaks showed that the same strain was involved at the 3 companies. However, this was different from wild boar isolates, which meant that direct transmission through wild boar was not likely in this case (Abril *et al.,* 2011). One clinical case in 2010 involving a ram infected with *B. ovis* (brucellosis in rams) was the first case for 9 years. Brucellosis in rams occurred in particular between 1994 and 2001. A total of 101 cases were reported during this period, between 1 and 34 cases per year.

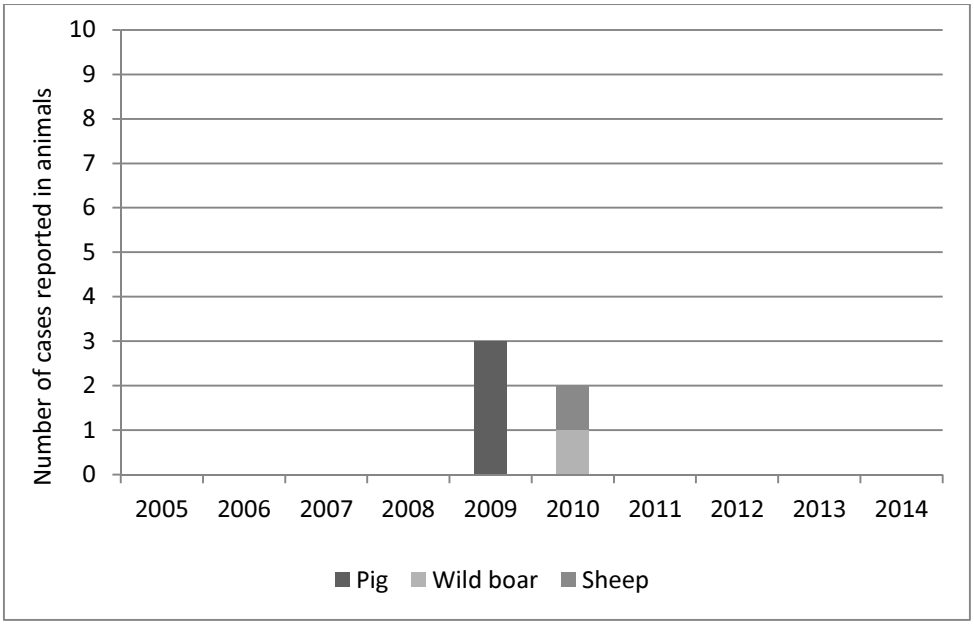


Figure 9.n: Number of cases of brucellosis reported in animals, 2005–2014
(Source: Information system for reporting epidemics (InfoSM), FSVO; as at February 2015)

9.7.3 Measures

The measures for cattle (*B. abortus*) are regulated in the TSV in Art.150–157, 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.

9.7.4 Assessment of the situation

The numbers of cases reported in humans remain low. In Switzerland, human infections with *Brucella* can usually be traced back to stays abroad or 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 *Brucella suis* in woolly pigs in the Canton of Geneva in 2009 shows that epizootics that have not been diagnosed for years can recur at any time. The transportation of animals played a crucial part here. *B. suis* serovar 2 is detected in wild boar (Wu *et al.*, 2011). Pigs kept on open land are at particular risk, along with those kept near woods (< 50 m) and with low fences (< 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.

9.8 Echinococcosis

Echinococcosis is an infection with tapeworms (in definitive hosts) or their larval stages (metacestodes, bladder worms) of the *Echinococcus* species (in intermediate/dead-end hosts). A distinction is made in particular between 2 main pathogens, which present themselves in different ways: *Echinococcus multilocularis* (alveolar echinococcosis (AE)) and *Echinococcus granulosus* (cystic echinococcosis (CE)).

a) Alveolar echinococcosis (AE)

Humans are a dead-end host. They become infected by eating infectious eggs. This is possible through consumption of contaminated foods (through faecal contamination) or through contact with infected definitive hosts and contaminated objects or soil. The initial symptoms are usually upper abdominal symptoms and/or jaundice. A severe, cancer-like illness develops, usually localised in the liver. It is estimated that 5–15 years generally elapse between the time of infection and diagnosis of AE in humans. 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.* Transmission from human to human is not possible.
The definitive hosts are foxes and occasionally dogs or cats. They become infected by eating intermediate hosts containing tapeworm bladder worms (particularly voles, but in rare cases also other rodents). The bladder worms develop within a month into adult tapeworms in the small intestine of the definitive host, and then in turn begin to excrete infectious eggs.

b) Cystic echinococcosis (CE)

Once again, humans are a dead-end host. Often no symptoms are noticed, or only non-specific symptoms that depend on the organ in which the parasites are located. The definitive hosts are dogs, which become infected by eating bladder worms in the organs of slaughtered animals. The main intermediate hosts that have been described are sheep, cattle, horses and pigs. *Echinococcus granulosus sensu lato* no longer occurs in Switzerland. There are sporadic imported cases in humans and animals (particularly dogs, cattle and sheep).

9.8.1 Obligation to report to the authorities and numbers of cases in humans

There has been no obligation 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 due to alveolar echinococcosis every year. The number of people hospitalised due to AE for the first time rose from 17 in 2008 to 45 in 2013. This corresponds to an increase in the hospitalisation rate from 0.22 (2008) to 0.55 (2013) cases per 100,000 inhabitants. Since 2008, there have to date been an additional 3 to 11 new infections every year. Even if infections can occur in people as young as 19 years of age, the risk of infection increases with age (15–24 years: 0.2 cases per 100,000; 25–44 years: 0.3 per 100,000; 45–64 years: 0.5 per 100,000; over 65 years: 1.2 per 100,000). Data from before 2005 collected by the Institute of Parasitology in Zurich had already shown that the incidence had increased by a factor of about 2.5, from 0.1 new infections per 100,000 inhabitants (mean for 1993–2000) to 0.26 (mean for 2001–2005) (Schweiger *et al*., 2007). This development followed a sharp rise in fox populations, after successful combating of rabies. Analyses of cases between 1984 and 2010 showed that the incidence was significantly higher in rural regions than in urban areas (0.26 versus 0.12 per 100,000 inhabitants). Nevertheless, more than half (55%) of these cases occurred in cities, particularly in the urban areas around Kreuzlingen, Zurich, Bern, Basel, Lausanne and Geneva. On average, patients were 52–55 years old at the time of diagnosis. The risk of infection increased significantly with each additional 20 years of life (Torgerson *et al*., 2008).

9.8.2 Obligation to report to the authorities and monitoring in animals

Echinococcosis in animals is an epizootic that must be monitored (TSV, Art. 5). 8 cases of echinococcosis were reported in animals in 2014 (dogs (6), monkeys (2)). In the last 10 years (2005–2014), the number of cases reported has fluctuated between 1 and 11 per year. Dogs were most frequently affected (48%), followed by foxes (30%) (**Figure 9.o**). In 2012 the first case since 1991 was reported in a cow, which was noticed during meat inspections. No laboratory results were available for this case, and there was therefore no more specific information about the species.

Foxes are the main host of *E. multilocularis.* The prevalence in foxes is estimated at 30% to 70%. The latest figures from the Institute of Parasitology at the University of Zurich show that in eastern Switzerland, 53% (105 out of 200, 2012) and 57% (57 out of 100, 2013) of hunted foxes tested positive for *E. multilocularis*.

Between 2006 and 2011, the Institute of Parasitology at the University of Zurich evaluated the deworming of foxes as an option for combating this disease. In 2007/08, it was shown that the deworming of foxes reduced the proportion of *E. multilocularis*-positive fox droppings from 25% (361 out of 1,376) to 19% (202 out of 1,044). Without deworming, the proportion that were positive remained at 25% (63 out of 254). However, the positive effect of deworming lasts for only a short time.

Dogs have been identified as a significant risk factor for echinococcosis in various case-control studies. Although dogs are rarely infested, they can excrete large quantities of infectious eggs. The prevalence in dogs is estimated at 0.3–0.4%. This means that about 10% of dogs will be infected with *Echinococcus* once during their lives and could contaminate the environment with infectious eggs. A study in 2009 showed that farm dogs with free access to their environment were more frequently infected with *E. multilocularis* than domestic dogs (3 out of 124 (2.4%) farm dogs versus 0 out of 118 domestic dogs). Around 7–19% of fox tapeworm eggs in the settlement area could thus be excreted by dogs. The fur of dogs was also examined for the presence of worm eggs. Worm eggs were detected in the fur of 2 farm dogs.

Monitoring studies carried out by the Institute of Parasitology at the University of Zurich on mice in the Zurich area in 2007/08 showed that 17% of the mice were infected with *E. multilocularis* (100 out of 634 in 2007 and 66 out of 393 in 2008). In 2013, barely any mice were infected with *E. multilocularis* (3 out of 200 *A. scherman* and 6 out of 259 *M. arvalis*).

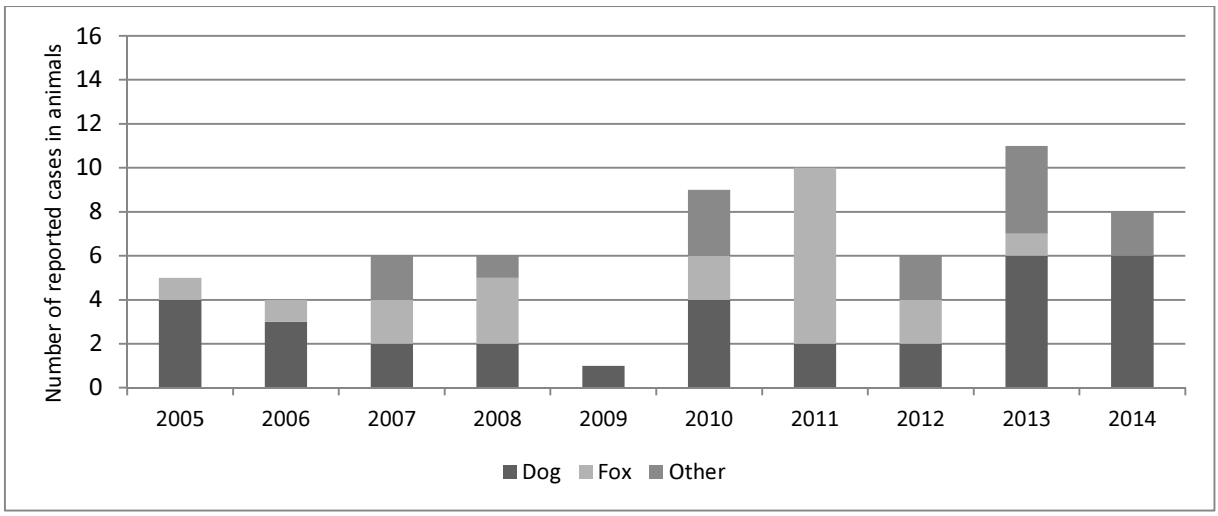


Figure 9.o: Number of cases of echinococcosis reported in animals, 2005–2014
(Source: Information system for reporting epidemics (InfoSM), FSVO; as at February 2015)

9.8.3 Measures

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

9.8.4 Assessment of the situation

Cases of alveolar echinococcosis (AE) are rare, even if 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 significantly improved in the last 40 years. The average life expectancy of people infected with AE is around 2 to 4 years lower than for the population as a whole. In many cases people recover completely. Further monitoring of the epidemiological situation will be important over the next few years.
The increased risk of infection has been explained by the higher density of foxes (successful combating of rabies in the 1980s, less hunting) and by their advance into urban areas. It can be assumed that the fox population will remain high in the next few years and that foxes will continue to advance into urban areas. *E. multilocularis* is increasingly being detected in densely populated areas. Due to waste (e.g. food scraps on compost heaps), a plentiful supply of berries and fruit, deliberate feeding by residents and a sympathetic attitude to foxes, the density of foxes here is often high, with over 10 mature foxes per square kilometre. As 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. Contamination of the environment with eggs of the fox tapeworm is thought to be high at the transition from urban to rural areas. Infections can be significantly reduced by deworming foxes. Any programme to combat fox tapeworm should give priority to densely populated areas. However, the cost of deworming is high, as it is necessary to put down bait regularly over a long period in order to achieve any effect. The focus is therefore currently on keeping the public well informed about individual preventative measures (e.g. hand hygiene after working in the garden, washing of 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 settlement 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).

Infections with *E. granulosus* are rare in Switzerland. Dogs that are imported from areas contaminated with *E. granulosus* should undergo tapeworm treatment immediately before entry into Switzerland. Slaughterhouse waste should be fed to dogs only if it has been cooked or frozen to at least –18°C for 3 days.

10 Outbreaks of foodborne diseases

It is rare in Switzerland for an entire group of people to become infected with a pathogen via food. Only 11 outbreaks of foodborne disease were recorded in the year under review. These involved infections with *Listeria*, *Salmonella*, *Campylobacter* and toxin-producing pathogens such as *Staphylococcus aureus* and *Bacillus cereus*. With regard to foods, particular caution is required with sprouts and raw meat, although cheese and ready-to-eat lettuce have also been identified as sources of infection.

11 outbreaks of foodborne disease were recorded in the year under review (**Table 10.a**), confirming the trend towards a plateau in the frequency of such events in Switzerland at a low level. Some outbreaks resulted in more extensive epidemiological investigations, such as a cluster of cases involving *Listeria monocytogenes* serotype 4b (Food Control 57, 14–17, 2015). The source of infection was found to be ready-to-eat lettuce that, due to a technical fault at the production site, had exceeded the specified limits. As *Listeria* is widespread in nature, it has been known for a long time that these germs can also contaminate foods of vegetable origin such as lettuce (Archiv für Lebensmittelhygiene 43, 108–110, 1992). However, there have been no outbreaks of listeriosis in Switzerland in the last 25 years due to such products. The outbreak that occurred should therefore be classed as an extremely rare event, and lettuce can continue to be regarded as a safe product.

It is also worth mentioning an outbreak caused by staphylococcal enterotoxins A and D in Tomme soft cheese (Journal of Dairy Science 98, 2944–2948). Diseases caused by such toxins are frequently possible, particularly with artisanal cheeses, as another outbreak involving goats' cheese proved. There were 2 recorded outbreaks of salmonellosis. In one event, a cluster of cases of *Salmonella szentes*, a rare serovar, were linked to sprouts, while Switzerland was also affected by an international outbreak involving a large number of cases of *Salmonella bovismorbificans* (manuscript accepted for publication), in which the focus was on Germany. Patients mainly became infected in a restaurant, and the source of the pathogen was again identified as sprouts.

Campylobacteriosis remains the most important zoonosis in Switzerland, with a high number of cases in humans every year. A significant risk factor for campylobacteriosis is foods such as "fondue Chinoise", with which consumers come into contact with raw meat and meat juice. It was therefore not surprising that an outbreak of campylobacteriosis was recorded in connection with a barbecue and raw chicken meat.
Incorrect storage of food (errors in times and temperature) can under some circumstances allow any toxin-producing germs that are present to multiply rapidly, which in one case led to an outbreak affecting 41 people. The cause was a sauce that was contaminated with *Bacillus cereus*. Finally, a further 4 outbreaks were recorded at catering establishments. Although no causal agents were identified, it had to be assumed in view of the symptoms that these cases involved poisoning.

Pathogen	Number of people taken ill	Number of people hospitalised	Contaminated food	Place consumed	Cause
L. monocytogenes serovar 4b	31	Unknown	Lettuce	Home	Cross-contamination
S. bovismorbificans	23	Unknown	Sprouts	Restaurant	Unknown
S. szentes	11	Unknown	Sprouts	Home	Unknown
Campylobacter spp.	5	2	Barbecue with raw chicken meat	Restaurant	Cross-contamination
Staphylococcal enterotoxins A and D	15	0	Tomme soft cheese	School	Incorrect storage
Staphylococcal enterotoxins G and I	5	0	Goats' cheese	Home	Unknown
B. cereus	41	4	Gratin and béchamel sauce	Canteen	Temperature error
Unknown	2	2	Kebab	Takeaway	Unknown
Unknown	6	0	Spaghetti sauce	Restaurant	Unknown
Unknown	3	1	Fried veal sausages	Takeaway	Unknown
Unknown	30	0	Salad with sauce	School	Unknown

Table 10.a: Outbreaks of foodborne disease and pathogens or toxins involved, 2014

11 Antibiotic resistance

To estimate and prevent the spread of bacteria with resistance to antibiotics from animal populations to humans, a monitoring programme was set up in Switzerland in 2006. In 2014 it was adapted to the EU's new guidelines, to allow data to be compared with data from other countries in future. Among the pathogens that cause zoonoses, the rate of resistance of *C. jejuni* to ciprofloxacin increased further, as did the occurrence of methicillin-resistant *Staphylococcus aureus* in slaughtered pigs.

11.1 Antibiotic resistance in livestock and meat

Since 2006, various standardised tests have been carried out as part of a national monitoring programme in Switzerland to determine the situation with regard to antibiotic resistance in fattening poultry, fattening pigs and cattle.
The development of resistance in the pathogens that cause zoonoses and in indicator germs in livestock is monitored continuously in order to gain a better understanding of the risk of the spread of resistance within animal populations and from them via the food chain to humans. In addition, the monitoring of development of resistance in bacteria forms the basis for drawing up measures to improve the situation.
To ensure that data can still be obtained that are comparable with those of other countries, the monitoring system was adapted to the EU's new guidelines in the year under review. In future, fattening poultry will be inspected every two years, while fattening pigs and cattle will be inspected in the alternate years. Meat samples from the species that are inspected will also be taken in the retail trade and tested for the presence of resistant germs.
In 2014, healthy broiler chickens were sampled in slaughterhouses, as well as chicken meat from the retail trade. As in the previous year, nasal swab samples from slaughtered pigs were also tested for methicillin-resistant *Staphylococcus aureus* (MRSA), a strain of bacteria known for its multiple resistance to all antibiotics with active substances in the β-lactam group that are currently available on the market.

11.1.1 Causes of zoonoses

In the case of *C. jejuni* from broiler chickens, resistance to ciprofloxacin has increased significantly since 2006. It rose from 15% in 2006 to over 45.9% in 2014. Resistance to erythromycin is rarely observed in *C. jejuni* from broiler chickens. Only 1 such isolate was found in the year under review, which also showed resistance to ciprofloxacin. Fluoroquinolones, which include ciprofloxacin, and macrolides, which include erythromycin, are classified as critical antibiotics with top priority (WHO/OIE/FAO), as these groups of active substances are the treatment of choice for severe forms of campylobacteriosis and salmonellosis in humans.

Type of sample	Number of samples	Germs investigated	Number of resistance tests
Cloacal swab from broiler chickens	493	*Campylobacter* spp.	174
Cloacal swab from broiler chickens	205	*E. coli*	200
Cloacal swab from broiler chickens	350	*Enterococci*	282
Cloacal swab from broiler chickens	297	ESBL/AmpC lactamase-producing *E. coli*	124
Nasal swab from fattening pigs	298	MRSA	79
Meat samples (chicken)	319	MRSA	22
Meat samples (chicken)	319	ESBL/AmpC lactamase-producing *E. coli*	232
Meat samples (chicken)	319	Carbapenemases	0
Clinical material/all species	–	*Salmonella* spp.	42
Clinical material/all species	–	*S. typhimurium*	18
Clinical material/all species	–	Monophasic *S. typhimurium*	13
Clinical material/all species	–	*S. enteritidis*	11

Table 11.a: Overview of data collected as part of the monitoring programme for antibiotic resistance in 2014, broken down according to the type and number of samples, stating the germs investigated and the number of resistance tests

The occurrence of MRSA in slaughtered pigs in Switzerland has risen from 2% to 26.5% since 2009. The results show that in particular, a clonal MRSA line is spreading rapidly through the Swiss slaughtered pig population (CC398-t034). This type of MRSA is also commonly found in livestock in other European countries and is one of the forms of so-called livestock-associated MRSA. Although it is known that people who are in close contact with animals are at increased risk of being MRSA carriers, such livestock-associated MRSA rarely causes infections in humans.
MRSA was found in a total of 6.9% of chicken meat samples, with a much lower occurrence in meat produced in Switzerland (1%) than in meat from abroad (16%). While food is not currently regarded as a source of transmission of MRSA to humans, high levels of multi-resistant germs are not desirable here.
If *Salmonella* are isolated in ungulates or poultry, they must be sent to the reference laboratory for further classification, where they will undergo resistance testing. However, *Salmonella* occur only rarely in Swiss animal populations and resistance rates are low, particularly with *S. enteritidis* and *S. typhimurium*. The risk of transmission of resistant *Salmonella* from foods of animal origin produced in Switzerland to humans is therefore estimated to be low.

11.1.2 Indicator germs

Resistance to ampicillin, ciprofloxacin, nalidixic acid, sulfamethoxazole and tetracycline has often been found in the past in commensal *E. coli* isolates from broiler chickens. The rate of resistance to these active substances increased in the period 2006–2012, but since then has fallen again significantly.
Tests on the *Enterococci* species *E. faecalis* and *E. faecium* from broiler chickens show that resistance to erythromycin and tetracycline is often found. However, resistance to these antibiotics has declined significantly in *E. faecalis* in the last few years. No resistance to vancomycin or linezolid was found in either of the two strains.
Extended spectrum beta-lactamase (ESBL)/AmpC lactamase-producing *E. coli* were detected in 41.8% of broiler chicken flocks and 73.3% of chicken meat samples in the year under review, using selective detection methods. The increase in prevalence in the broiler chicken flocks is probably due to a change

in laboratory methods. ESBL/AmpC lactamase-producing *E. coli* was also found considerably more often in chicken meat of foreign origin (85.6%) than in chicken meat produced in Switzerland (65.5%). However, no carbapenemase-producing *E. coli* was found.
Although transmission of such bacteria to humans can be prevented with good kitchen hygiene and by ensuring that meat is carefully cooked through, multi-resistant germs should not be present on food, or should be present only in small quantities.

11.1.3 Conclusion

Resistance is found both in the pathogens that cause zoonoses and in indicator germs in healthy broiler chickens in Switzerland. However, the frequency of resistance to several classes of active substances in indicator germs has declined significantly in recent years. In particular, the occurrence of resistant germs such as MRSA and ESBL/AmpC lactamase-producing *E. coli* has been found to be increasing or to remain unchanged at a high level; the frequency of these germs is influenced not only by the use of antibiotics alone, but also by other factors such as the transportation of animals, biosafety and slaughterhouse hygiene.
The development of resistant bacteria in animal populations must continue to be monitored. This is the only way to estimate the threat that they pose to humans and animals. Coordinated measures are currently being developed with all the sectors involved as part of the national strategy for antibiotic resistance (StAR), with the aim of ensuring that antibiotics remain effective in protecting human and animal health in the long term.