Sari Jaakola
Outi Lyytikäinen
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Infectious Diseases in Finland 2011

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Jaakola Sari, Lyytikäinen Outi, Rimhanen-Finne Ruska,
Salmenlinna Saara, Vuopio Jaana, Roivainen Merja, Löflund Jan-Erik,
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INFECTIOUS DISEASES IN FINLAND 2011

NATIONAL INSTITUTE
FOR HEALTH AND WELFARE

National Institute for Health and Welfare (THL)
Department of Infectious Disease Surveillance and Control
PB 30 (Mannerheimintie 166)
FI-00271 Helsinki, Finland
Tel. 029 524 6000
http://www.thl.fi/infektiotaudit

Editors: Sari Jaakola, Outi Lyytikäinen, Ruska Rimhanen-Finne, Saara Salmenlinna, Jaana Vuopio, Merja Roivainen, Jan-Erik Löflund, Markku Kuusi and Petri Ruutu.

In addition to commentary, the report includes figures and tables that are not **employed** in our regular reporting. Distributions by gender, age and region are available on our website.
The data for some of the diseases in the National Infectious Diseases Register (NIDR) will still be updated after the figures have been published in print.
Up-to-date figures are available at **http://tartuntatautirekisteri.fi/tilastot**

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Contents

Introduction

No significant changes occurred in national or international cooperation in the surveillance and prevention of infectious diseases in 2011.

An important change for the surveillance on antimicrobial susceptibility in 2011 was the introduction of the EUCAST (European Committee on Antimicrobial Susceptibility Testing) breakpoints instead of the previously used US breakpoints.

To enhance the surveillance of infectious diseases, geographically representative information on health care visits due to infections is needed. The collecting of this information is enabled by the AvoHILMO system, a repository of data on the causes for health care visits in primary health care compiled and updated on a daily basis. The component systems are undergoing rapid development, as major IT system suppliers are adding the required functions to the new software versions to be deployed. What is vital for achieving high-quality monitoring is to implement comprehensive registration and correct encoding of reasons for health care visits as a part of routine reception procedure.

EPIDEMIOLOGICAL OVERVIEW 2011

The influenza epidemic of winter 2010–2011, from December to March, was caused by the influenza A(H1N1)pdm09 virus, also known as the swine flu virus, which, after its first outbreak in Finland in early autumn 2009, returned at the time of the usual seasonal influenza epidemic. The lower number of laboratory-confirmed influenza A infections was probably due to the immunity conferred by the pandemic vaccinations of 2009 (coverage 51%) or by an earlier infection. A record number of cases of influenza B were noted. The number of cases of whooping cough increased on previous years, indicating incomplete protection by vaccination in the population. The mycoplasma epidemic that began late in 2010 continued throughout 2011.

The number of rotavirus cases among children under the age of 5 was half that of the previous year, probably because of the effect of the recently inroduced rotavirus vaccine. The number of cases of listeria also decreased, and the variant that had previously been the most commonly found in fish products almost completely disappeared. *Salmonella* Oranienburg caused several clusters around Finland.

The number of acute hepatitis A and B infections has remained very low; the situation with hepatitis C is unchanged.

More cases of gonorrhoea were noted than at any time in the 2000s, and the fluoroquinolone resistance of the pathogen remains high. More than half of the patients diagnosed with HIV infections were foreigners; the majority of them had been infected through sexual contact. Most HIV infections are discovered at a late stage.

There were more MRSA blood culture findings than in the previous year, and the number of ESBL blood culture findings also increased on 2010.

Tuberculosis continues to present mainly in the elderly Finns, their infections contracted decades earlier becoming active. One out of four cases of tuberculosis were found among immigrants. The incidence of tuberculosis among children under the age of 5 has not increased since 2006, when the BCG vaccine was restricted to at-risk groups.

There was a considerably larger number of cases of measles than in previous years. Most of these were cases imported from Europe. The number of cases of tick-borne encephalitis (TBE) increased, but detailed assessment of the cases revealed that a substantial number of the cases reported as TBE were found not to be TBE after careful evaluation of clinical history and laboratory results. These cases will be removed from the National Infectious Diseases Register (NIDR). The number of borrelia infections reached a new all-time high since NIDR monitoring began in 1995.

Most malaria cases originated in Africa. Dengue fever cases have been on the increase in recent years.

The number of cases of serious infection among adults confirmed by blood culture continued to grow. Preliminary analyses show that, following the introduction of the pneumococcal conjugate vaccine in the national vaccination programme, severe pneumococcal infections in small children found in blood or CSF decreased substantially in 2011 compared with previous years.

Helsinki, 30 April 2012

Petri Ruutu
Head of Department

Respiratory infections

- The influenza A epidemic proved to be less severe than in the previous season, 2009–2010.
- A record number of cases of influenza B were noted, most of them in February and March.
- The number of cases of whooping cough was higher than in the previous year. Cases among infants indicate incomplete protection from vaccination in the population.
- A record number of cases of *Mycoplasma pneumoniae* was noted between October and December.

INFLUENZA

The influenza season began relatively early in 2010–2011. Following isolated findings of influenza A and B in November, both the influenza A epidemic and the influenza B epidemic began in December 2010.

Influenza A

Findings of influenza A reported to the NIDR indicate that the epidemic proper occurred between December 2010 and March 2011. The influenza A epidemic proved to be milder though longer than in the previous season, 2009–2010, when the pandemic wave occurred between October and December 2009. For the second season in a row, the influenza A(H1N1) pdm09 virus proved to be the epidemic pathogen in winter 2010–2011. The lower number of laboratory-confirmed influenza A infections was probably due to the immunity conferred by the pandemic vaccinations of 2009 (Pandemrix; coverage about 51%) or by an earlier infection.

In 2011, 1,900 findings of influenza A virus were reported to the NIDR, of which 666 were laboratory-confirmed findings of pandemic influenza A(H1N1) pdm09. The national influenza centre at the National Institute for Health and Welfare recorded 177 influenza A infections in 2011, of which 92% were caused by the influenza A(H1N1)pdm09 virus. The low number of cases of influenza A(H1N1)pdm09 virus infections reported to the NIDR is probably due to the fact that laboratories did not do as many virus sub-typings or send as many virus samples to be subtyped as during the pandemic.

Most frequently influenza A(H1N1)pdm09 infections was occured among young adults (aged 15 to 24). This may partly be explained by the fact that this age group had a lower vaccine coverage than the population on average and by the fact that surveillance locations for most influenza infections were at garrisons, where people of this age are undergoing military service.

During 2011, the genetic diversity of the influenza A(H1N1)pdm09 virus continued to grow. The epidemic pathogens of the influenza A(H1N1)pdm09 group constituted seven distinct genetic groups, of which five were found in Finland. No significant antigenic differences have been noted between these genetic groups and the vaccine virus, A/California/07/2009. The immunity conferred by the vaccine or a prior infection to influenza A(H1N1)pdm09 virus strains may be considered to have been good.

Although a considerable proportion of the influenza A infections diagnosed proved to have been caused by influenza A(H1N1)pdm09 virus strains, isolated cases of influenza A(H3N2) subtype were noted in Finland at the beginning of 2011 and especially towards the end of the year. The influenza A(H3N2) virus strains found are in a different genetic group than the vaccine virus, A/Perth/16/2009 H3N2. Antigenic differences were found between these virus groups.

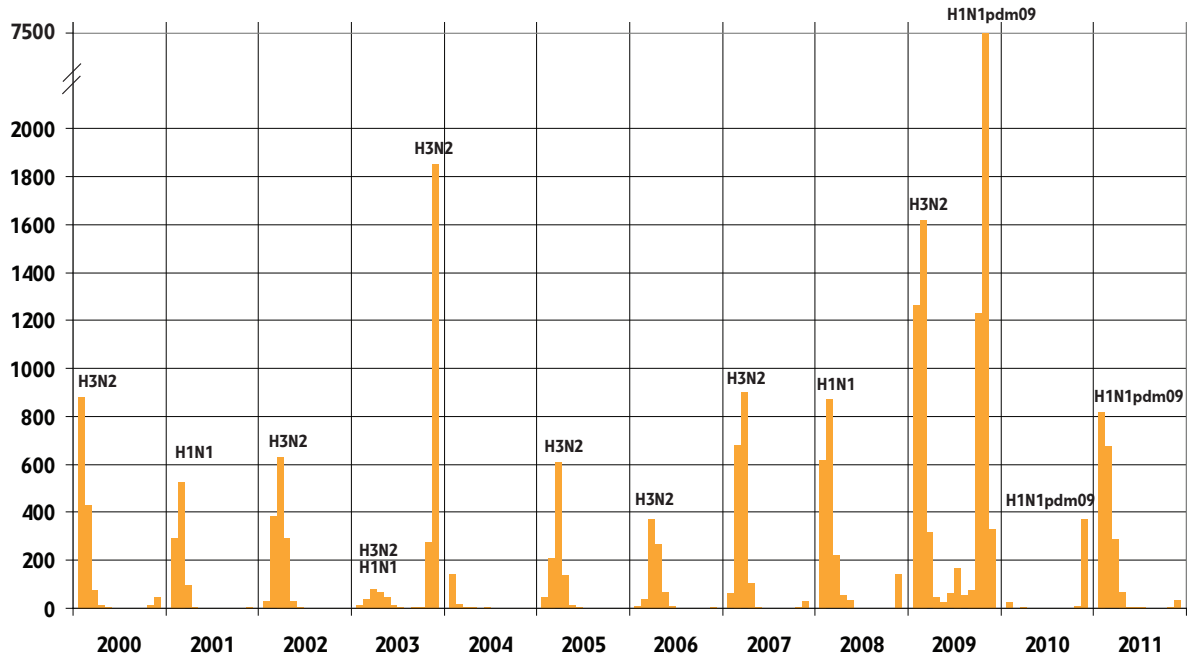

Figure 1. Cases of influenza A by epidemic virus type per month, 2000–2011 (no. of cases).

Influenza B

In 2011, a record-breaking 3,444 cases of influenza B were reported to the NIDR (2010:140), of which the vast majority occurred in February or March (78%). The previous significant influenza B epidemic occurred in 2008, with 1,775 cases of influenza B recorded. Infections were found in all age groups, but above all in the age groups of children aged 5 to 14 and adults aged 30 to 44. The incidence was highest in the hospital districts of Southwest Finland, Helsinki and Uusimaa, and Satakunta.

Of the two influenza B lineages circling the world, viruses of the Victoria lineage have been principally generating epidemics over the past two years. In 2011, the Victoria lineage virus strains continued to be the dominant epidemic pathogens, although the incidence of Yamagata lineage virus strains in influenza B infections has increased. Virus strains from both the Victoria and the Yamagata lineages were found in Finland in 2011, the slight majority being from the former. Both lineages continued to be found throughout the influenza B epidemic.

Because of international agreements, only one lineage of influenza B may be included in the seasonal influenza vaccination. The other two virus components in the vaccine are influenza A viruses of subtypes H1N1 and H3N2. For the last three years, the influenza B virus included in the vaccine has been from the Victoria lineage, B/Brisbane/60/2008. The virus strains from the Victoria lineage found in Finland were both genetically and antigenically similar to the vaccine virus. By contrast, the protection conferred by the vaccine against virus strains from the Yamagata lineage found in Finland was probably weak, since the virus strains from the Yamagata lineage found in Finland were genetically and antigenically somewhat different from the Yamagata vaccine virus that was previously used in the vaccine in autumn 2008 (B/Florida/4/2007).

RSV

In 2011, 1,524 cases of RSV confirmed with laboratory tests were reported to the NIDR (2010: 2,597). In long-term surveillance, a major RSV epidemic has been observed in Finland every other winter, often starting in November or December. One was expected in winter 2009–2010, but it remained insignificant in scale and did not peak until March and April. It is suspected that the autumn 2009 pandemic delayed the onset of the RSV epidemic. That the number of cases recorded in 2011 was low was due to a minor spring epidemic in March and April and the larger winter epidemic not beginning until December.

The incidence of RSV varied by hospital district (5–50/100,000), most likely caused by differences in the use of laboratory diagnostics. As always, nine out of ten RSV cases involved children aged 0 to 4. Even

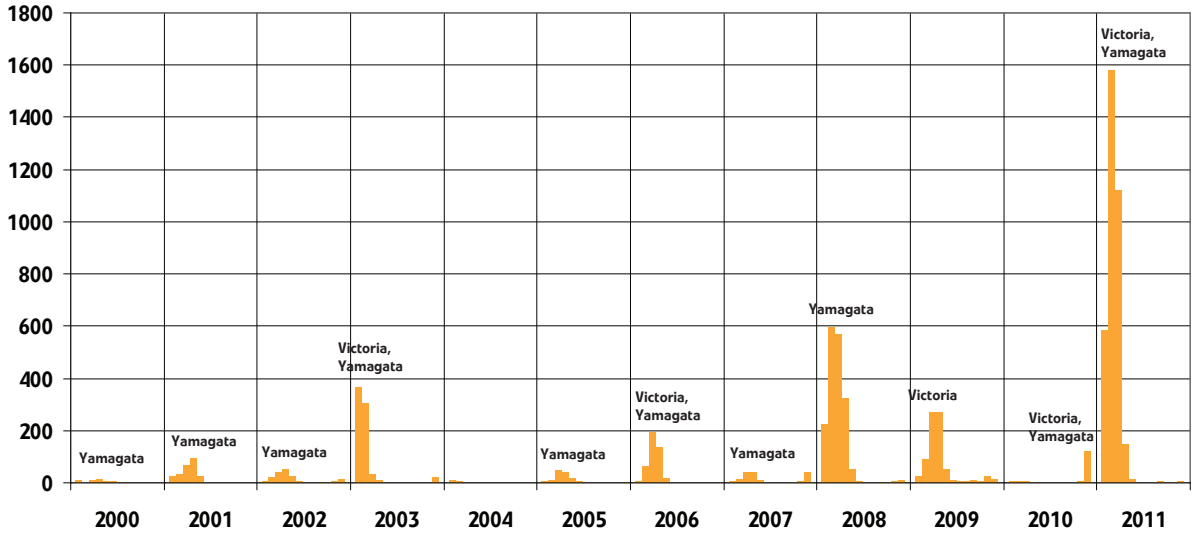

Figure 2. Cases of influenza B by epidemic virus type per month, 2000–2011 (no. of cases).

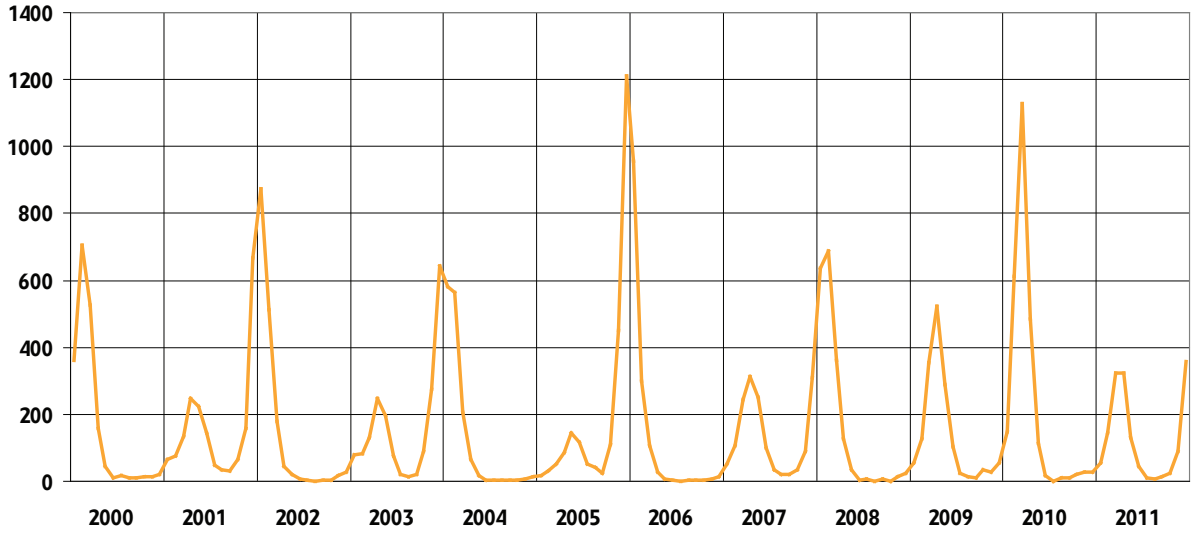

Figure 3. Cases of RSV per month, 2000–2011 (no. of cases).

though infections occur in all age groups, babies and small children constitute the majority of cases leading to hospitalisation and laboratory diagnostics.

Reliable quick tests for RSV diagnostics have been developed for use at health centres, outpatient clinics and hospitals. In hospital conditions, RSV is easily transmitted between patients. Quick tests make it easier to identify RSV infections and therefore to prevent further transmission. Specialised virus laboratories increasingly use nucleid acid amplification methods for diagnosing RSV.

LEGIONELLA

In 2011, 54 suspected findings of legionellosis were reported to the NIDR. The diagnosis was based on detection of antigen in the urine in 5 cases and in sputum in one case, on bronchoalveolar lavage fluid culture or PCR in 1 case, and on serological methods in the rest. Further study showed that the clinical presentation was consistent with legionella pneumonia in only five cases. In all of these, the urine antigen test was positive (and in one case the culture too). All of the patients with legionella pneumonia were men

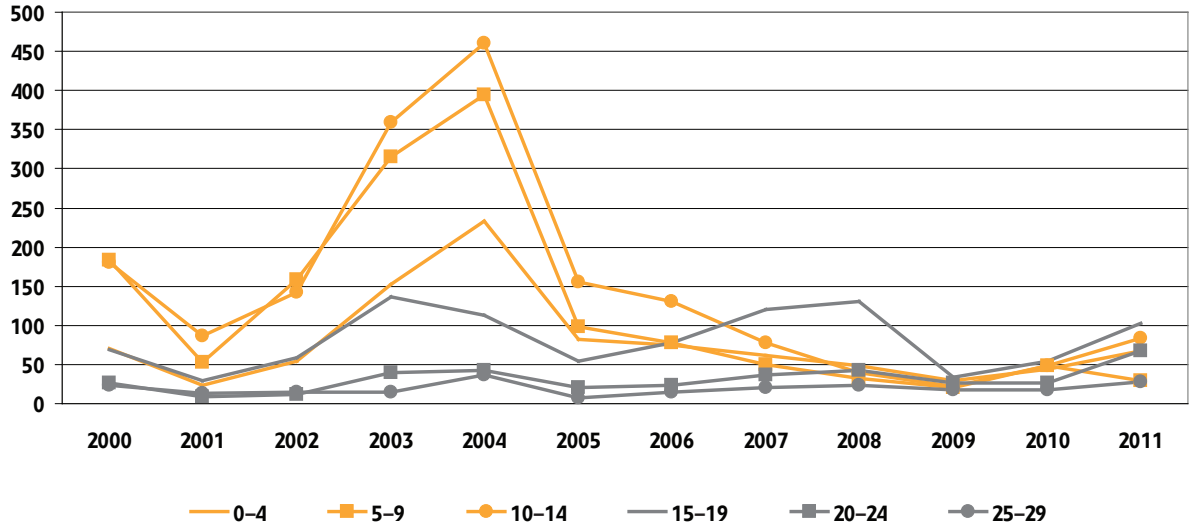

Figure 4. Cases of whooping cough in the children and young adult age groups, 2000–2011 (no. of cases).

aged between 51 and 63, and all had been abroad before falling ill. The accommodation data of these patients were reported to ELDSNET (European Legionnaires' Diseases Surveillance Network), which collects data on travel-associated legionellosis.

Late in 2011, an epidemic consistent with a milder form of legionellosis, Pontiac fever, was noted in the Helsinki metropolitan area: 11 people who had all used the same jacuzzi or swimming pool suite presented with a fever within 2 to 4 days; elevated levels of legionella antibodies were found in eight of them. None of them was diagnosed with pneumonia. A strain of *Legionella anisa* bacterium was isolated from the water and surfaces of the jacuzzi, even though the water had apparently been appropriately chlorinated. This bacterium rarely causes an illness. Keeping jacuzzis clean requires sufficiently high levels of chlorine, continuous water circulation and regular cleaning. Corporate in-house jacuzzis use are not subject to mandatory regular inspections in Finland, unlike jacuzzis at public swimming halls and spas, which are monitored by the environmental health authorities. According to the most recent guidelines concerning legionella from the WHO and the EWGLI (European Working Group for Legionella Infections), all jacuzzis should inspected at least every three months for legionella bacteria.

WHOOPING COUGH

In 2011, the number of whooping cough cases reported to the NIDR totalled 555 (10/100,000). The number of cases was clearly higher than in 2010, 343 (6/100,000). The cases were concentrated in the age groups of 10 to 24 and under 12 months. Fifty-three of the patients were under 12 months old, with 35 under three months old. Illness in infancy indicates insufficient herd immunity. Until 2007, vaccinations in adolescence were given between the age of 11 and 13. This was then raised to the age of 14 to 15. Because of the transition, very few vaccinations were given between 2009 and 2011. This created a temporarily less well protected cohort in adolescent age groups, and consequently increased morbidity has been observed. It is recommended that vaccinations in adolescence be initiated in the 8th grade.

The diagnosis of nearly all (49) patients under 12 months old was based on a PCR test, while the majority of cases were diagnosed by antibody testing. Once again, incidence of whooping cough varied greatly by hospital district (0–16/100,000), being highest in the hospital district of Helsinki and Uusimaa, while no cases at all were recorded on Åland. There was a whooping cough epidemic at Parolannummi garrison in autumn 2011. In 2011, the first discovery was made of strains of *Bordetella pertussis* that do not produce the vaccine antigen pertactin. The vaccine may be of weaker potency against these strains.

ADENOVIRUS

In 2011, almost 800 confirmed cases of adenovirus infection were recorded (2010: 900). The largest number of cases was in the age group of under 5, but there were also cases in the age groups 5 to 9, 15 to 19 and 20 to 24. In terms of time, the largest numbers of cases were recorded in February and March (more than 100 cases per month) and towards the end of the year (about 70 per month).

There are 57 known types of adenovirus. Some of them cause respiratory infections, while others cause intestinal, eye or other infections. Adenoviruses are common pathogens in infants and small children; they occur more rarely in adults. Adenovirus infections among conscripts tend to appear as epidemics whenever new arrivals enter service, particularly in February and March, i.e. after the annual influenza epidemic. However, in winter 2011 the adenovirus epidemic practically coincided with the influenza A and B epidemics in February and March. There were numerous adenovirus infections in several garrisons, some of them severe. In summer 2011, the adenovirus situation was rather uneventful, but towards autumn the frequency of infections increased again.

Laboratories use various testing methods to detect adenoviruses in clinical samples. Antigen detection, virus cultures and PCR are sensitive and reliable methods used at specialised virus laboratories.

PARAINFLUENZA

Parainfluenza viruses are grouped under one heading in the NIDR, even though laboratories usually differentiate between parainfluenza viruses 1, 2 and 3. The number of confirmed parainfluenza infections in 2011 was 279 (2010: 393), most of them in the age group 0 to 4. The months with the highest numbers of cases (more than 50 per month) were January, February and March. Parainfluenza infections are found in all age groups. A child's first parainfluenza infections may lead to a severe condition, even requiring hospitalisation. In an older child or an adult, a parainfluenza infection is typically much milder in its symptoms. It often presents as an ordinary upper respiratory tract infection and requires no laboratory diagnostics. In special groups, however, such as immune deficiency patients, parainfluenza viruses can cause quite serious symptoms. Parainfluenza virus type 3 causes minor epidemics in the summer and autumn nearly every year. By contrast, parainfluenza viruses types 1 and 2 do not cause epidemics every year. Parainfluenza viruses, especially type 1, typically cause laryngitis in small children.

MYCOPLASMA

In 2011, there were more than 7,800 laboratory-confirmed cases of *M. pneumoniae*. Because of an increase in incidence noted during 2010 (peaking in March 2011), it was predicted that an epidemic would emerge in the following winter too, since *M. pneumoniae* epidemics tend to be double-peaked. This prediction was fulfilled; the number of cases began to increase in autumn 2011, with record numbers reported to the NIDR between October and December (more than 3,700). Part of this growth is due to increased awareness and more frequent sampling. A survey conducted by the National Institute for Health and Welfare indicates that the number of samples tested was up to four times higher than in the previous year, but then again there were also large numbers of clinical cases recorded at health care visits. *M. pneumoniae* epidemics were also reported in the other Nordic countries, the UK and the Netherlands.

Most of the reported cases were aged 5 to 19. Laboratory diagnoses were mostly based on IgM antibody detection. The largest number of cases was recorded in the hospital district of Helsinki and Uusimaa (about 2,500), but the incidence was highest in the Central Bothnia and Northern Savo hospital districts (>200/100,000). It has been noted in recent years in Asia in particular that *M. pneumoniae* has developed macrolide resistance. In Europe, this has been relatively rare (about 3%). Nucleic acid detection methods are rarely used in *M. pneumoniae* diagnostics in Finland, and it has thus not been possible to study here whether strains of the bacteria are macrolide-resistant.

CHLAMYDIAL PNEUMONIA

The number of cases of *Chlamydia pneumoniae* recorded in 2011 was 400, double the number in the previous year and four times as many as in 2009. This may be partly explained by increased testing: during the *M. pneumoniae* epidemic of 2011, many patients with respiratory symptoms were also tested for *C. pneumoniae* antibodies, as it is impossible to distinguish between these two infections on the basis of symptoms alone. The growth trend in the number of cases of *C. pneumoniae* that began in 2010 continued in 2011, and a unusually large number of cases was reported between January and April and between September and November. The incidence was highest in the Central Bothnia, Kainuu and Vaasa hospital districts (19–23/100,000), while the largest number of cases was recorded in the hospital district of Hel-

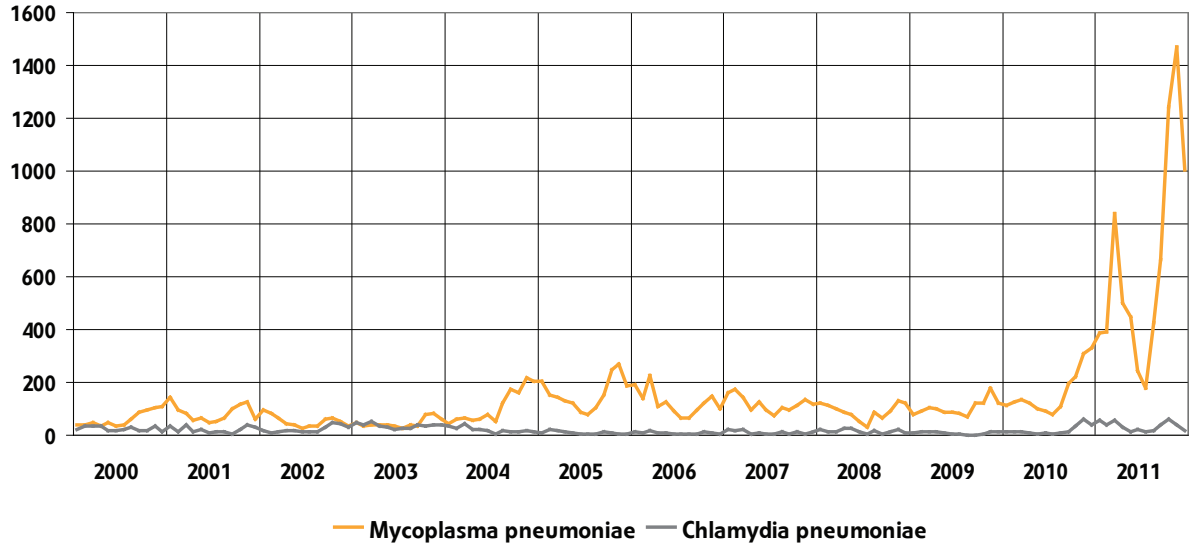

Figure 5. Cases of Mycoplasma pneumoniae and Chlamydia pneumoniae per month, 2000–2011 (no. of cases).

sinki and Uusimaa (120). *C. pneumoniae* was most commonly found among children and adolescents (aged 5 to 19) and in the age group of 30 to 49. The diagnosis was based on antibody detection in nearly all cases.

Intestinal infections

- The *Salmonella* Oranienburg bacterium caused clusters of intestinal infections all around Finland.
- Half as many number of cases of rotavirus infection among children under the age of 5 as in 2010.
- Fewer cases of listeria were recorded than in the previous year. Only one case caused by the most common type of Listeria bacterium found in fish products in the previous year (genotype 96) was recorded in 2011.

SALMONELLA

In 2011, there were 2,099 reported cases of salmonella (2010: 2,438), 55% of them in women patients. Annual incidence in the entire country was 39/100,000 population. The incidence was highest in the hospital district of Lapland (57/100,000) and lowest in the hospital district of Southern Bothnia (23/100,000), and the highest number of cases was in the age group 25 to 29.

There were 5 diagnosed cases of the *S.* Typhi serotype, which causes typhoid and 3 cases of *S.* Paratyphi, which causes paratyphoid: one each of *S.* Paratyphi B, *S.* Paratyphi A and *S.* Paratyphi C. All patients had acquired the infection abroad. India was the most common sources for *S.* Typhi and *S.* Paratyphi infections.

Out of all cases of salmonella, 338 (18%) were of domestic origin, roughly the same percentage as in earlier years. The incidence of domestic infections was 6/100,000. Domestic salmonella infections were caused by 45 different serotypes. The leading four serotypes were Typhimurium (25%), Enteritidis (14%), Oranienburg (13%) and Group B (12%). Unlike in previous years, a new sub-group has emerged within Group B: monophasic *S.* Typhimurium. In 2011, these strains accounted for 35 domestic cases (2010: 5; 2009: 5). Most of the monophasic strains of Typhimurium found in 2011 belonged to the multiresistant phage type FT 195 (resistance profile ASSuTe), for which a reservoir is not known to exist in domestic production animals. Out of the rest of the domestic cases of Typhimurium found, the majority (60%) were caused by the traditional endemic phage type FT 1. The second most common phage type (17%) was FT NST (not specific type). The FT 1 strains are divided into 12 genotypes, most of which (77%), as in previous years, were of the genotype STYM 1, which is susceptible to antimicrobials. All 87 domestic Typhimurium strains were further typed using the MLVA method based on differences between repeated sequences in DNA; the majority of the strains in the domestic genotype STYM 1 (63%) presented with the MLVA profile 3-16-NA-NA-0311.

There were 47 cases caused by the domestic Enteritidis serotype. These were divided into 14 phage types, most of them (more than half) of the types FT 8, FT 1, FT 4B and FT 2, and into 20 genotypes, the most common being SENT 1.

Information on whether a salmonella infection was acquired in Finland or abroad remained lacking for 150 (7%) cases reported to the NIDR in 2011. The total number of foreign salmonella infections was 1,614. The salmonella infections acquired abroad represented 122 serotypes. The *S.* Enteritidis serotype caused 612 (38%) of the cases with foreign origin. The next most common serotypes acquired abroad were Group B (144 cases), Typhimurium (80) and Stanley (68). The majority (71%) of the foreign cases caused by Group B were caused by the monophasic, multiresistant phage type FT 193 of *S.* Typhimurium (the most common resistance profile being ASSuTe and the most common source being Thailand). In the remaining foreign cases too, the most common source was Thailand (29%), followed by Turkey (13%), India (6%) and Egypt (6%).

There were 564 strains phage-typed from the foreign *S.* Enteritidis strains and 72 from the *S.* Typhimurium strains. The most common phage types of

Table 1. The most common serotypes of salmonella cases, 2000–2011 (excluding S. Typhi and S. Paratyphi) (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Infection acquired abroad (Source: NIDR)												
Salmonella Enteritidis	1052	1243	904	887	758	834	879	735	1066	657	778	612
Salmonella group B	45	32	33	23	37	38	55	93	166	119	103	144
Salmonella Typhimurium	205	143	115	155	183	194	141	246	198	166	142	80
Salmonella Stanley	44	63	65	67	105	113	116	175	136	111	98	68
Salmonella Corvallis	7	21	10	40	39	60	56	59	70	68	42	45
Salmonella Virchow	50	79	55	67	74	88	80	135	115	90	77	32
Salmonella Abony	10	11	8	9	4	4	1	9	3	18	31	32
Salmonella Infantis	23	34	20	16	33	39	31	54	31	42	42	31
Salmonella Bareilly	9	17	6	8	5	17	19	18	27	14	18	27
Salmonella Weltevreden	12	10	11	5	12	14	15	25	14	36	14	27
Other	765	723	617	585	590	544	634	724	780	618	685	516
Total	2222	2376	1844	1862	1840	1945	2027	2273	2606	1939	2030	1614
Domestically acquired infections (Source: Bacteriology Unit)												
Salmonella Typhimurium	124	152	222	137	132	241	170	150	80	134	132	94
Salmonella Enteritidis	52	63	42	61	81	75	69	61	49	48	44	47
Salmonella Oranienburg	0	0	7	4	1	1	0	0	7	2	2	43
Salmonella group B	5	2	3	2	7	1	4	11	5	7	8	40
Salmonella group E	1	0	0	0	0	1	1	0	0	1	7	13
Salmonella Agona	27	41	16	12	27	32	11	40	15	2	2	11
Salmonella Infantis	7	19	4	4	4	11	6	3	7	2	9	10
Salmonella Napoli	0	1	0	3	2	0	2	0	2	0	6	6
Salmonella Newport	11	5	3	16	8	3	9	23	70	9	8	6
Salmonella Give	1	1	0	0	1	4	39	3	2	1	2	5
Salmonella Poona	8	1	4	9	0	2	5	0	14	12	8	5
Salmonella Senftenberg	1	4	0	0	0	1	0	1	0	0	5	5
Other	88	101	105	62	73	71	81	80	123	91	101	53
Total	325	390	406	310	336	443	397	372	374	309	334	338

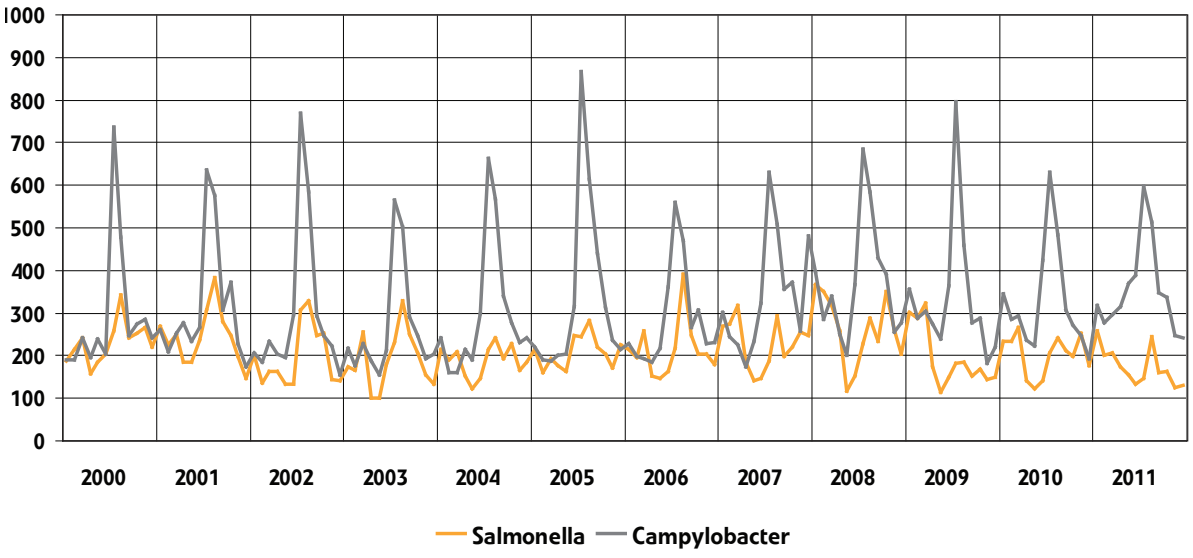

Figure 6. Salmonella and campylobacter cases per month, 2000–2011 (no. of cases).

S. Enteritidis were FT 14B (18%; from 9 different countries, mostly Estonia, Turkey and Spain), FT 21 (16%; from 17 countries, mostly Turkey) and FT 1 (15%; from 17 countries, mostly Russia), while the most common phage types of *S.* Typhimurium were FT NST (22%; from 11 countries), FT 41 (18%; all from Mauritius) and FT 120 (13%; mostly from Thailand and Vietnam).

CAMPYLOBACTER

In 2011, the NIDR received 4,251 notifications of campylobacter infections, 307 cases fewer than in 2010. *Campylobacter jejuni* remained the single most common species of campylobacter (2,017 cases); there were 180 reported cases of *C. coli,* and no fewer than 1,840 cases where the campylobacter species was not specified. The hippurat test used to distinguish between species has been abandoned in some laboratories, because it cannot correctly identify all strains. The incidence in the entire population was 78/100,000. Men accounted for 54% of the cases, and the highest number of cases was in the age group 20 to 49. Incidence was highest in the hospital district of Helsinki and Uusimaa (122/100,000).

The seasonal variation was typical for campylobacter: incidence was highest in July and August. (Figure 6) Of the cases in 2011, 547 (13%) were domestic in origin, although 40% of the cases lacked data on the country of acquisition. A total of 1,960 cases (46%) were reported to be associated with a trip abroad; the leading sources for these infections was Thailand (504 cases), followed by Turkey (269), Spain (242) and India (125).

YERSINIA

Yersinia enterocolitica

In 2011, the NIDR received 514 notifications of *Yersinia enterocolitica*, a 12% increase on 2010 (458). In 2011, the incidence in the entire country was 10/100,000 population. Based on the cases reported to the NIDR, the incidence was highest in the age group 45 to 54 (13/100,000) and lowest in the age group 10 to 14 (3/100,000). There is great regional variation in the *Yersinia enterocolitica* findings. The incidence was highest in the hospital district of Helsinki and Uusimaa and the Kainuu hospital district (17/100,000) and lowest in the Eastern Savo and Western Bothnia hospital districts (less than 2/100,000).

Typing data were given for only about 35% of *Y. enterocolitica* cases in 2011, which makes it difficult to draw conclusions about the percentages of the various bio/serotypes. However, the majority of the types reported were of the non-pathogenic biotype 1A (26% of all cases of *Y. enterocolitica*). A separate study found that *Y. enterocolitica* bacteria isolated from elderly patients tend to be non-pathogenic strains, while pathogenic strains are over-represented in small children.

Yersinia strains may be sent to the National Institute for Health and Welfare for typing if necessary. In November and December 2011, an unusually large number of *Y. enterocolitica* strains of the serotype O:9 were sent to the National Institute for Health and Welfare. These strains came from 10 different persons, about half of whom were from eastern Finland. In the previous year, the same serotype was isolated

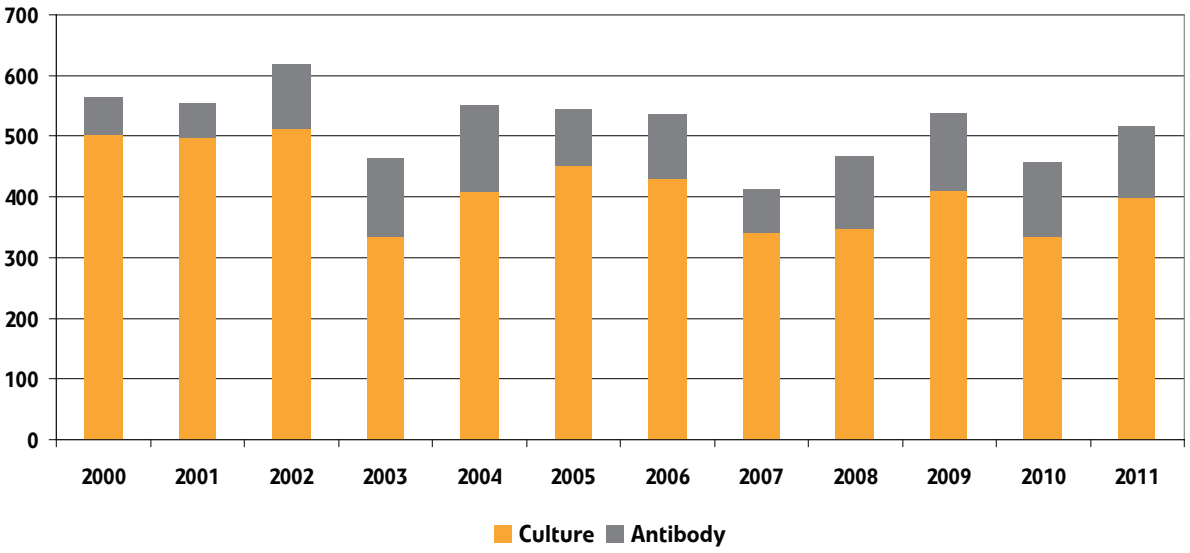

Figure 7. Yersinia enterocolitica culture and antibody findings, 2000–2011 (no. of cases).

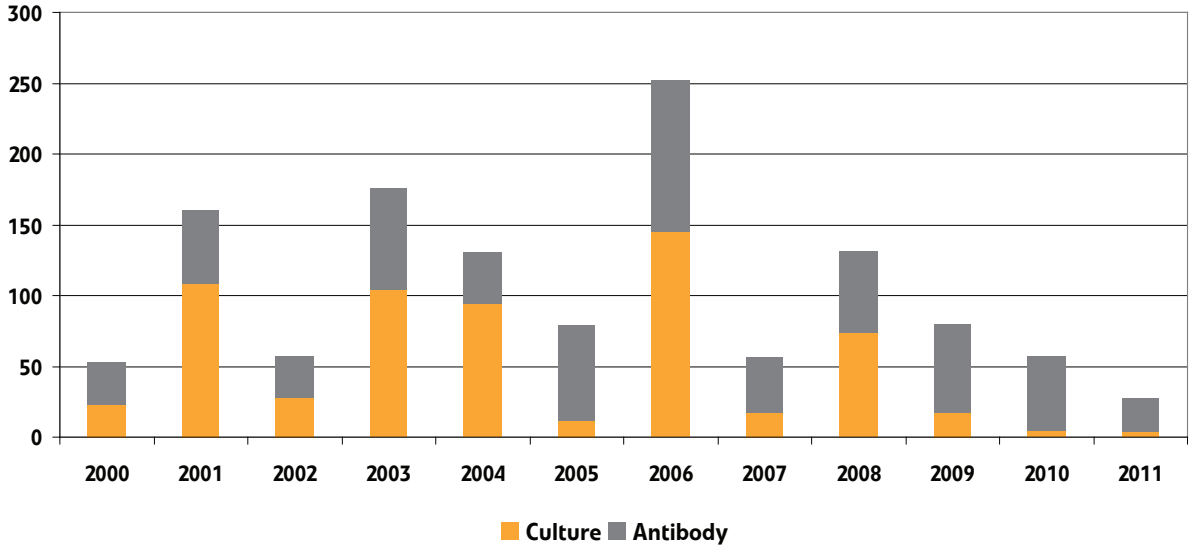

Figure 8. Yersinia pseudotuberculosis culture and antibody findings, 2000–2011 (no. of cases).

in 7 patients in Leppävirta in eastern Finland; in the outbreak in question, 42 patients developed gastrointestinal symptoms.

Yersinia pseudotuberculosis

The number of *Yersinia pseudotuberculosis* cases (28 cases) continued to decrease, having been 58 in 2010. In 2011, the incidence in the entire country was 0.5/100,000 population. The number of cases is too low to reliably indicate any regional variation, and 13 hospital districts diagnosed no cases at all in 2011. Outbreaks cause variation in the annual incidence of cases of *Y. pseudotuberculosis*.

SHIGELLA

In 2011, the incidence of shigellosis was 3.0/100,000. There were 127 reported cases, 50 in men and 77 in women. The median age of patients was 41 (range 1 to 79), with a very small percentage of patients under the age of 20 (15 cases) or over the age of 65 (7 cases). About half of the cases (63) were reported in the hospital district of Helsinki and Uusimaa. Six hospital districts had no diagnosed cases. Of the total, 123 infections (97%) were acquired abroad and 3 in Finland. In one case, the country of acquisition was not specified. Three of the patients presented simultaneously with a Salmonella infection, one had an infection caused by two different species of Shigella, and one patient had evidently caught one infection in India in May or June and another one in Nepal in November (different strains). The most common countries of origin were Egypt (42 cases) and India (30). The prevailing Shigella species were *Shigella sonnei* (84 cases), followed by *S. flexneri* (24) and *S. boydii* (6). There were 5 reported cases of *S. dysenteriae* (no shigatoxin-producing serotypes were among the pathogens). Of all Shigella strains, 79% were multiresistant (R to at least 4 out of 12 antimicrobials tested), and 34% were completely resistant or had reduced susceptibility to ciprofloxacin (MIC 0.125–12 mg/l). Moreover, 6 strains were completely resistant to cephotaxim (some are estimated to produce ESBL enzyme).

ENTEROHAEMORRHAGIC ESCHERICHIA COLI (EHEC)

In 2011, 27 microbiologically confirmed cases of enterohaemorrhagic *Escherichia coli* (EHEC) were reported to the NIDR (0.5/100,000). This is more than in 2010 (20). Foreign acquisition accounted for 5 of the cases. There were 11 women and 16 men. The patients were under the age of 15 in 18 cases, 11 of them under the age of 5. The majority of diagnoses were made between June and September. Farm contact was involved in 9 cases. Six patients suffered from haemolytic-uremic syndrome as a complication. Five small clusters of infections were identified among people who lived in the same household or had otherwise been in close contact with the original patients. One of the cases was connected with the outbreak of EHEC-EAEC O104:H4 in Germany spread through fenugreek sprouts, where more than 4,200 people fell ill.

The O157-serogroup strains were divided into two common phage types (FT 8 and FT 88) and caused a total of 11 cases. There were 16 cases of serogroup

Non-O157. The strains isolated from these were typed into the O groups O26, O104, O121, O145 and O91. The O antigen remained untyped for two strains (ONT). Most of the strains had the genes to produce either Stx2 shigatoxin or both Stx1 and Stx2 shigatoxin.

NOROVIRUS

In 2011, 1,591 cases of norovirus were reported, clearly less than the annual numbers between 2006 and 2010; 931 (59%) of the cases were in women. 70% of the cases were reported between January and April. More than half (58%) of the patients were over 75 years of age, but infections were diagnosed in all age groups. Cases were reported in all hospital districts.

The year 2011 was the fifth year running when new variants of the norovirus GII.4 genotype, emerging every one or two years, caused a widespread epidemic in Finland, as indeed they did elsewhere in the world. As in previous years (2007–2010), most of the outbreaks that occurred in 2011 were institutional outbreaks. This also explains the high incidence among the elderly.

The norovirus outbreaks in 2011 were caused almost exclusively by norovirus variant GII.4 2010, which is a recombination of two earlier GII.4 variants that emerged in 2006 and 2008. In some cases, the pathogen proved to be an earlier, now rare norovirus variant GII.4 2006b or a newer variant GII.4 which on the basis of polymerase nucleic acid sequencing cannot be classified as any known variant of GII.4. There were also individual outbreaks caused by other genotypes (GI.4, GI.b, GI.7, GII.b, GII.7, GII.g) in 2011.

Norovirus has become one of the most common causes of food- or water-borne outbreaks in the 2000s. In 2011, food-borne outbreaks were caused by noroviruses of both genogroup I (GI.3, GI.4) and genogroup II (GII.7, GII.4 2010).

ROTAVIRUS

Only 292 cases of rotavirus were reported in 2011, one fifth of the average annual number before the introduction of rotavirus vaccines. Rotavirus vaccines began to be supplied by pharmacies in summer 2006. The vaccine was initially underused, but by 2008 one child in three was receiving a rotavirus vaccination, paid for by the parents. The rotavirus vaccine was finally added to the national vaccination programme in September 2009.

The incidence was again clearly highest in children under five years of age (63/100,000), but this was half of the figure in the previous year. Before the addition of the vaccine to the vaccination programme, the incidence in this age group on average was 460/100,000. In other words, the incidence in 2011 was less than 15% of that figure. With increasing vaccination of infants, the proportion of cases in older age groups will increase. In 2011, over one third of all cases were in patients aged 5 or over, whereas this figure was never higher than about 10% in previous years.

In 2011, most of the cases were caused by rotavirus serotypes G1P[8], G4P[8], G3P[8], G2P[4] and G9P[8]. The illnesses caused by the various serotypes are very similar. Rotavirus diagnoses are mainly based on quick tests that do not indicate the type of virus. In the future, however, it will become increasingly

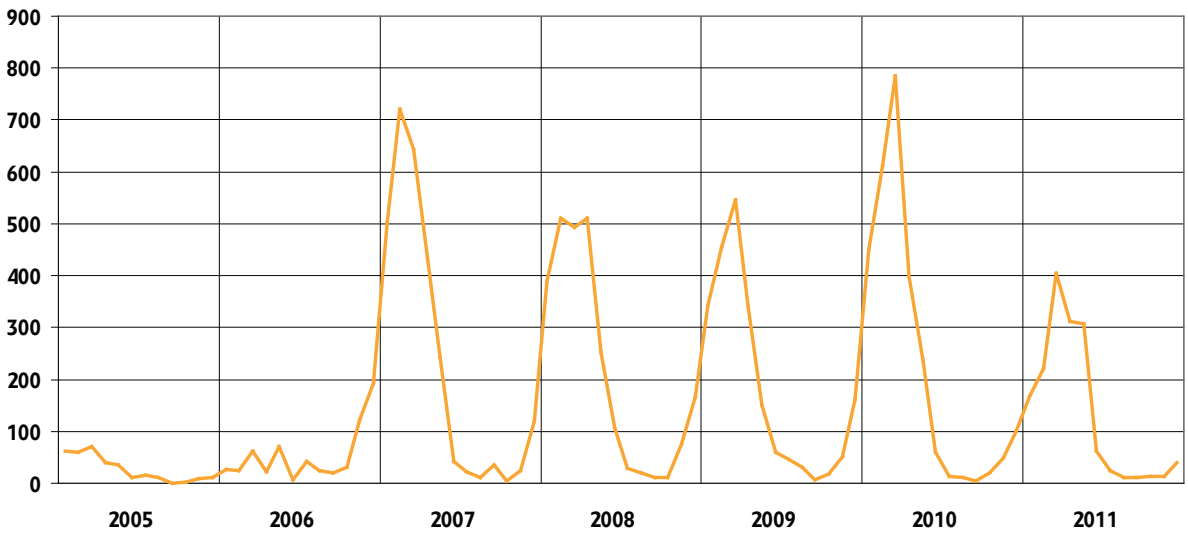

Figure 9. Cases of norovirus infection per month, 2005–2011 (no. of cases).

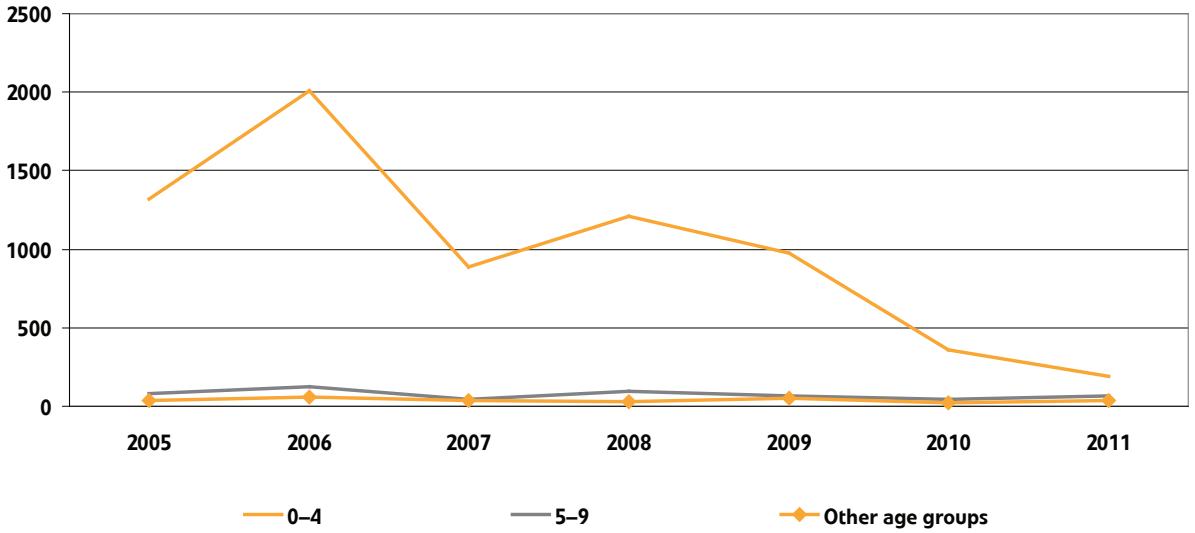

Figure 10. Cases of rotavirus by age groups 2005–2011 (no. of cases).

important to identify the type of rotavirus so that it can be established which serotypes cause infections regardless of the vaccination.

ENTEROVIRUS

In 2011, 219 enterovirus cases were reported to the NIDR, about half of the number reported in the epidemic year 2010 (560). Men accounted for 127 (58%) of the cases. Almost half (92, 42%) of the patients were under the age of 10, and the majority of cases involved patients under the age of 20. The epidemic season began fairly early, as in the previous year; cases began to emerge in May and June. Although various strains of Coxsackie A and B viruses and echoviruses circulated in the population in 2011, no major epidemic clusters were observed. CV-A2, CV-B3, echovirus 6, echovirus 18 and enterovirus 71 were found in patients diagnosed with encephalitis or meningitis or presenting with unspecific fever. Cases caused by CV-A6 and echovirus 30 were also recorded. CV-A16 caused cases of hand, foot and mouth disease.

Enteroviruses cause conditions such as aseptic meningitis, encephalitis, myocarditis and typical enteroviral conditions (hand, foot and mouth disease, epidemic myalgia, etc.). Enterovirus diagnostics is increasingly based on the RT-PCR method, which does not distinguish between virus serotypes. Therefore, a stool culture remains the recommended and most useful way of diagnosing an enterovirus infection. Stool cultures also enable the monitoring of the possible circulation of polio viruses in the population; this monitoring is important and necessary even in Finland.

LISTERIA

Listeria monocytogenes infections were lower in number (44) than in the previous year. About half of the patients were over the age of 70; men and women were equally represented. No pregnancy-related cases were reported to the NIDR. The listeria cases were spread out across the country. The annual number of cases varied between 18 and 46 in the years 2000–2009; in 2010, 71 cases were reported.

Listeria was isolated from blood culture in 38 (88%) cases; in 6 cases, listeria was diagnosed from cerebrospinal fluid; for 4 of these, the diagnosis was confirmed by blood culture. The strains isolated from 43 patients were sent for further typing; 28 of them (65%) were found to be of serotype 1/2a, 10 (23%) of serotype 4b, 3 (7%) of serotype 1/2b and 2 (5%) of serotype 1/2c. The strains comprised 34 different PFGE genotypes of listeria.

In December 2010 and January 2011, four cases of listeriosis of genotype 62 were reported in Finland. All the patients were women aged over 80. All of them had access at their respective nursing homes at Christmas to gravad salmon prepared by a specific fish processing facility. A bacterial strain of genotype 62 identical to that found in the patients was isolated from the gravad salmon served at one of the nursing homes involved, and production hygiene at the production facility was improved. In 2011, genotype 62 was the most commonly found genotype, being found in 7 cases as opposed to one or two of each of the others. Genotype 62 has been found in the products of several fish producers.

In 2010, 71 serious cases of illness caused by listeria were found in Finland. Two thirds of the patients interviewed said that they had eaten gravad or cold-smoked fish. The most common type of listeria in these cases (genotype 96) was also the most commonly found type in foods in 2010. The majority of the findings came from a single fish processing facility, which was renovated. In 2011, genotype 96 was found in only one case.

Listeria monocytogenes causes severe infections in infants, pregnant women, patients with immune deficiency and the elderly. This infection is food-borne; risk foods include products made of unpasteurised milk and other animal- or plant-based foodstuffs and ready-made foods that are in cold storage for a long time and eaten unheated. Finland's risk foods include vacuum-packed salt-cured and cold-smoked fish products. Listeria bacteria may also occur in the food production environment, contaminating food products after the heat treatment in the production process.

CLOSTRIDIUM DIFFICILE

Clostridium difficile has been a finding reportable to the NIDR from the beginning of 2008. More than 6,000 cases were reported in 2011 (2010: >6,000; 2009: >7,000; 2008: >8,000), out of which 5,382 (2010: 4,804; 2009: 5,700; 2008: 6,301) involved a toxin-producing strain. Almost 60% of patients diagnosed with *C. difficile* were women, and about half were 75 years of age or older. The number of toxin-positive strains in patients under the age of 15 was 176 (3%) (2008–2010: 2–3%), of which just under one in five were isolated in patients under the age of 12 months. There was significant regional variation in the incidence (47–168/100,000), with the Kymenlaakso, Central Bothnia, Northern Bothnia and Satakunta hospital districts showing the highest incidence.

In severe cases or when a local outbreak is suspected, clinical laboratories have been asked to send *C. difficile* strains for further examination by the THL reference laboratory. There continued to be great local variation in the number of strains sent: although all hospital districts reported toxin-positive *C. difficile* cases, only 9 of them sent strains for genotyping. The total number of strains sent has been slightly declining, and last year accounted for less than 4% (194 out of 5,382) of the number of cases reported. The 194 strains typed at the THL in 2011 represented 32 ribotypes. The most common ribotypes apart from 027 were 001, 014, 023 and 002. Severe cases were caused by ribotypes 027, 020, 014 and 002; local clusters were caused by ribotypes 001, 002, 014, 012 and 023. In addition to PCR ribotype 027, other ribotypes (023 and 078) were detected that may be possible hyper-producers of toxin. So far, more than 90 different PCR ribotypes have been detected in Finland, of which about 30 have been identified as genotypes previously reported internationally.

SIGNIFICANT INTESTINAL INFECTION EPIDEMICS

From the beginning of 2010, municipal epidemic investigation working groups entered notifications of suspected food- and water-borne epidemics directly into the register IT system jointly maintained by the National Institute for Health and Welfare and the Finnish Food Safety Authority Evira, known as the RYMY information system. In the course of the year, 86 such notifications were entered. *Salmonella* Oranienburg caused several clusters of outbreaks around Finland. Several other intestinal infection clusters were investigated as well.

Salmonella Oranienburg epidemic in Savo

An outbreak of 41 cases of *Salmonella* Oranienburg was found beginning in early July, mainly in the regions of Etelä-Savo and Pohjois-Savo. The three genotypes identified in these cases (SORA 10, 25 and 26) were very similar, and the cases were therefore considered to be linked. The median age in these cases was 61 years, the range 7 to 90 years, and three out of five patients were men. More than half of the patients were related to each other in some way. The number of cases spiked in July and August compared with the rest of the year, and they were concentrated in the area around Pieksämäki, Varkaus and Leppävirta. The epidemic was investigated jointly by the National Institute for Health and Welfare, Finnish Food Safety Authority Evira and the local authorities. The source of the infections was never established, but suspicion focused on local seasonal produce, specifically strawberries. No information was available on investigations to trace the strawberries. A sample was taken from frozen strawberries in one of the households where a case occurred, but no salmonella was found.

Salmonella Oranienburg epidemic in Helsinki

An outbreak of 15 cases of *Salmonella* Oranienburg, genotype SORA 27 (different from the one in Savo) was found in August and September, the linking factor being eating lunch at a Helsinki restaurant. The median age in these cases was 36 years, the range 25 to 54 years, and most of the patients were men. The

epidemic was investigated jointly by the Helsinki Environment Centre, the Helsinki Epidemiology Unit and the National Institute for Health and Welfare. Analysis showed that there was no correlation between the illness and any specific course or any specific time of day. The infections were probably caused by shortcomings in the restaurant's own monitoring and standards of hygiene.

Cases of Salmonella Oranienburg in travellers returning from Turkey

Starting in June, cases of *Salmonella* Oranienburg genotype SORA 29 (the 12 strains typed were different in genotype from those found in Savo and Helsinki) were found in 23 people who, according to information in the NIDR, had been to Turkey prior to falling ill. The strains isolated were susceptible to microlides. The median age in these cases was 51 years, the range 10 to 70 years, and three out of five patients were women. Other EU Member States were informed of these cases through the European Centre for Disease Prevention and Control. One case of *Salmonella* Oranienburg among travellers returning from Turkey was found in Finland in 2009, and six cases in 2010.

Other salmonella clusters

Between March and August, a strain of *Salmonella* Enteritidis phage type 14B susceptible to antibiotics caused 42 cases of infection all around Finland; according to information in the NIDR, all cases were associated with travel to Estonia. Based on interviews with 9 of the patients, those who had fallen ill had been travelling in Tallinn, Pärnu and Tartu. They had no specific form of transport or itinerary in common. A total of 10 domestic strains of salmonella associated with this epidemic was genotyped (SENT 1). The strains were identical with those sent to the National Institute for Health and Welfare by the Estonian authorities from cases in Pärnu and from salmonella outbreaks in Johvi and Haapsalu. The source of infection for these epidemics was never identified. In 2010, 34 *S.* Enteritidis FT14B strains susceptible to all antibiotics were found, two of them from Estonia. In 2009, 44 similar strains were found, four of them from Estonia. The strains from 2009 and 2010 have not been genotyped.

Between May and August, a monophasic strain of *Salmonella* Typhimurium (4,5,12:i:-), phage type 195, genotype STYM 58, resistant to ampicillin, streptomycin, sulfonamide and tetracycline caused 22 cases of infection. The majority of these came from North Karelia Central Hospital; 18 cases were identified in connection with a neonatal salmonella epidemic, 10 of them children. Also, monophasic *S.* Typhimurium was found in 6 parents and 2 hospital employees. The genotype is rare and had not been previously found in Finland. Similar monophasic Typhimurium strains are generally associated with intestinal infections acquired in Thailand.

Infections caused by *Salmonella* group E (3.10:-:1.5), genotype E2 were found in 14 patients between June and August; 11 of these were deemed to be of domestic origin, and 9 were found in eastern Finland. The serotype is extremely rare in Finland, although it did also cause a similar epidemic in eastern Finland in 2010.

In July and August, cases of *Salmonella* Typhimurium, phage type NST (not specific type), genotype STYM 42 were found in 8 patients in the regions of Etelä-Savo and Pohjois-Savo. Because these cases emerged individually and their total number was small, investigation of the source was not undertaken.

Campylobacteriosis in Kanta-Häme

An elevated number of cases of campylobacteriosis was found around Hämeenlinna in October. The patients were adults of varying ages. Nine strains of *Campylobacter jejuni* were genotyped; 7 of these were found to be identical. The strains were compared to the strain of *C. jejuni* found at the water and wastewater works at Loppi in October. These proved to be dissimilar.

Toxin-mediated food poisoning epidemic in Savonlinna

In September, nearly 300 patients were found to have contracted toxin-mediated food poisoning after sharing a meal in Savonlinna. The source proved to be an inadequately cooled batch of lamb's meat, where large quantities of *Clostridium perfringens, S. aureus* and *L. monocytogenes* were found. In connection with this epidemic, 13 patient strains of *C. perfringens* were sent to the laboratory of the National Institute for Health and Welfare for examination; an enterotoxin gene was confirmed in 11 of these.

Botulism in Helsinki

Two members of a family in Helsinki were found to have contracted botulism poisoning in October; one of them died. Both had eaten almond-stuffed olives produced in Italy prior to falling ill. Botulinum toxin was found in the olive product, which was withdrawn from the market. Botulism is rare in Finland: isolated cases of food poisoning botulism have been recorded in 1999, 2006 and 2009.

Hepatitis

- The incidence of acute hepatitis A and B has remained low.

HEPATITIS A

In 2011, the NIDR received 14 notifications of hepatitis A (incidence: 0.3/100,000), approximately the same as in 2010. Ten patients were men, and 4 were women. The median age was 48 years (range 4 to 88). Cases were found in nine hospital districts, the largest number of them (4) in the hospital district of Helsinki and Uusimaa. In 7 of the cases, the infection was reported as having been acquired through food or water. One infection was acquired in Finland and 9 abroad; in 4 cases, the country of acquisition was not specified. Hepatitis A cases have remained at a low level since 2002–2003, probably because of high vaccination coverage among travellers and at-risk groups.

HEPATITIS B

In 2011, the NIDR received 24 notifications of acute hepatitis B (0.4/100,000); three out of four patients were men. The majority (79%) of patients were Finnish. The mode of transmission was given for 14 (42%) of the cases; in all of these, the infection had been contracted through sexual intercourse. The country of acquisition was reported for just over half of the cases (13). The majority (69%) of the infections were acquired abroad.

The annual number of cases of acute hepatitis B peaked at just over 300 in the late 1990s. Thereafter the figure plunged sharply. Since 2005, the annual number of cases has remained stable at a rather low level. This is probably because of high vaccination coverage among travellers and at-risk groups, and because of the needle and syringe exchange programme.

In 2011, 224 cases of chronic hepatitis B were reported (4.2/100,000). The majority (82%) of patients with chronic hepatitis B were foreigners. The annual number of cases of chronic hepatitis has been decreasing since it peaked at over 400 in 1996. This decrease has not been as sharp as that of the acute cases, however.

The NIDR criteria for classifying cases of acute hepatitis B have been further specified so that acute and chronic infections could be more reliably distinguished.

HEPATITIS C

In 2011, 1,132 new hepatitis C infections were reported to the NIDR, 63% of the patients being men and 37% women. The majority (86%) of these patients were Finnish. The mode of transmission was intravenous drug use in about half of the cases and sexual intercourse in 11% of them. In 35% of the cases, the mode of transmission was not reported. The country of acquisition was only reported in one out of three cases. In 79% of the cases where the country of acquisition was known, the infection was contracted in Finland. The largest age group, with 47% of the cases, was the age group of 20 to 29. The highest incidences were reported in the hospital districts of South Karelia (33/100,000), Northern Bothnia (29/100,000) and Helsinki and Uusimaa (26/100,000).

The annual number of hepatitis C infections peaked at 1,904 in 1997 and then decreased until 2009. In 2010, the annual number of cases increased slightly, and it remained stable in 2011.

The decrease in the annual number of cases was especially remarkable among men, being 46% from 1997 to 2011. The annual number of cases among women has also decreased, but not as much as among men; over the same period, the decrease among women was 24%. Women aged 20 to 24 have shown a slight increase in the annual number of cases, unlike any other group, and in 2011 this age group had a larger number of cases than ever before (129).

A very high percentage, around 80%, of intravenous drug users have been found to have hepatitis C antibodies. It will therefore be difficult to reverse the incidence trend even if the infection risks were brought under control.

Changes in the annual number of cases of hepatitis C should be interpreted with caution, because acute and chronic infections are not distinguished in the statistics. Surveillance is also made difficult by the fact that the data on the mode of transmission and country of acquisition are often incomplete. However, because hepatitis C is not transmitted easily through sexual contact and no community transmission has been detected, the cases where the mode of transmission is not reported may be assumed to be mainly related to intravenous drug use.

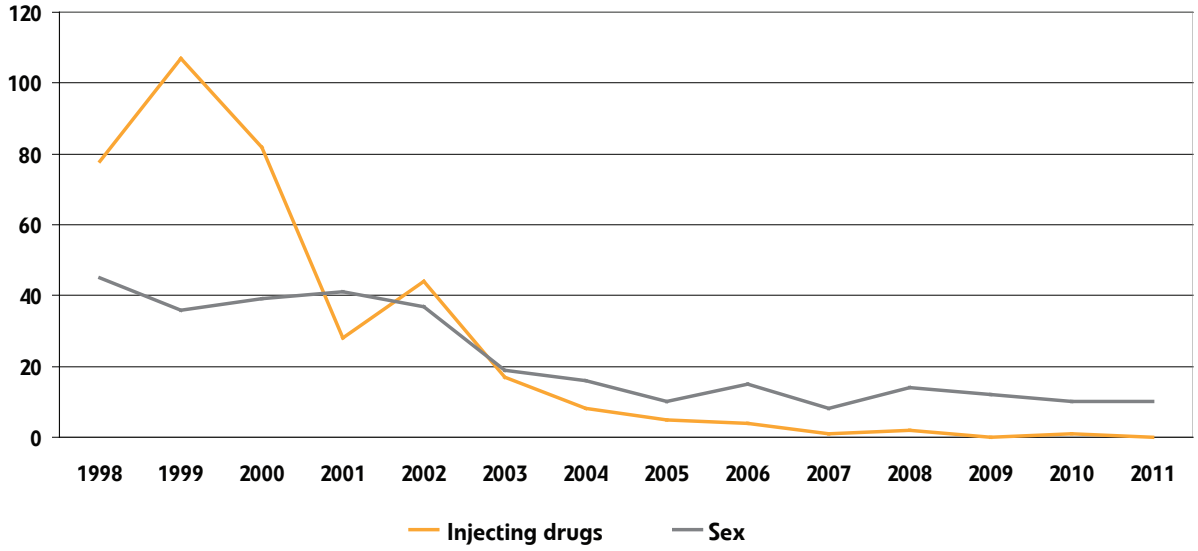

Figure 11. Acute hepatitis B cases involving intravenous drug use and sexually transmitted infections, 1998–2011 (no. of cases).

Table 2. All cases of hepatitis C according to physicians´ reports, organised by means of transmission 2000–2011, (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Injecting drugs	937	826	717	637	615	629	578	468	574	516	596	600
Sex	40	42	45	46	60	62	72	68	74	70	73	86
Perinatal	6	3	3	1	11	5	5	3	11	9	10	11
Blood products	25	20	19	22	18	24	7	21	20	2	9	7
Other	31	31	28	35	31	34	37	28	34	31	38	39
Unknown	700	565	560	524	506	490	469	577	429	422	406	417
Total	1739	1487	1372	1265	1241	1244	1168	1165	1142	1050	1132	1160

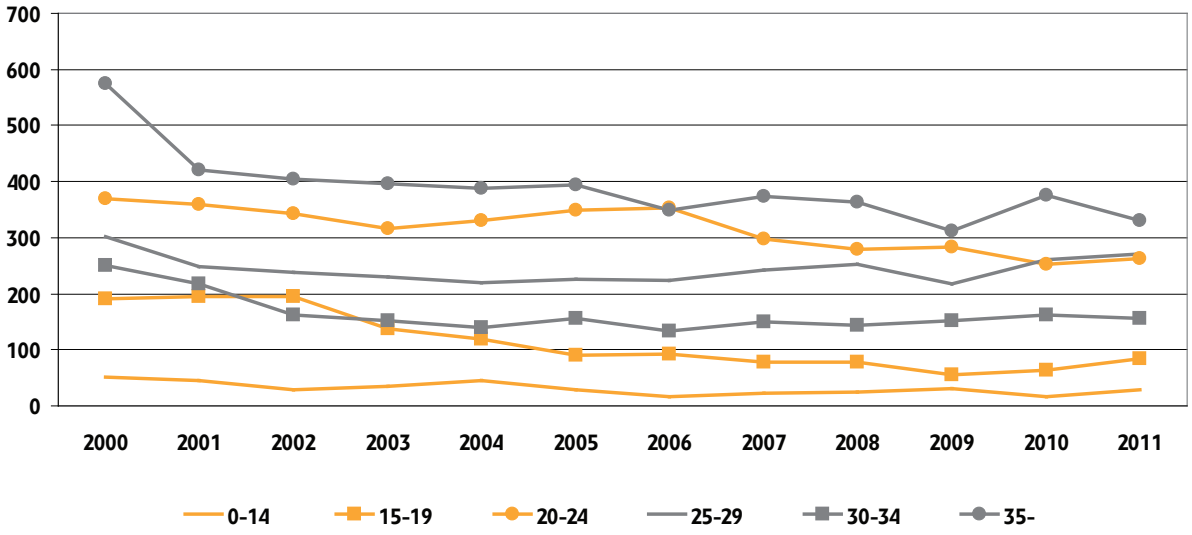

Figure 12. Hepatitis C by age group, 2000–2011 (no. of cases).

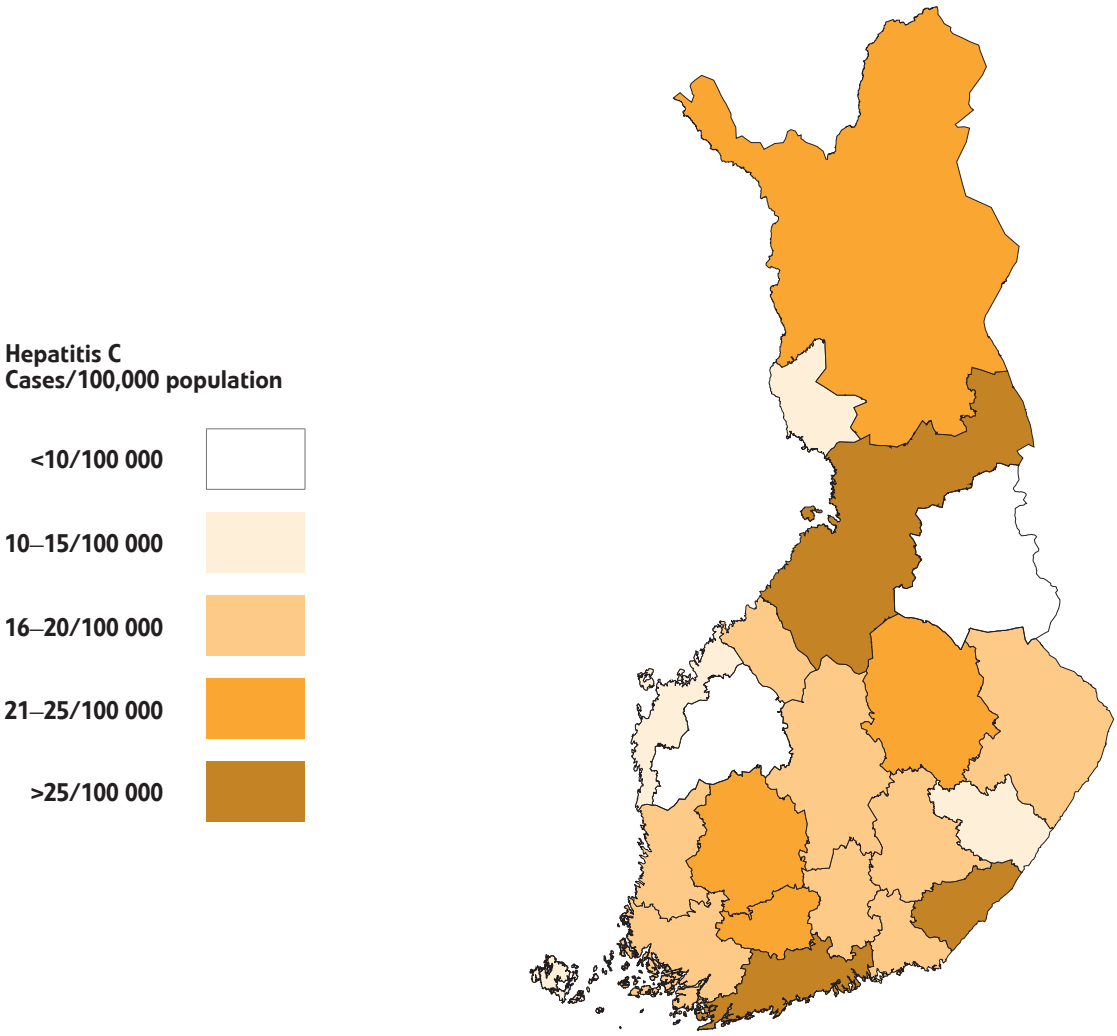

Figure 13. Incidence of Hepatitis C in Finland 2011.

Sexually transmitted diseases

- There were more cases of chlamydia than in the previous year.
- More cases of gonorrhoea were recorded than ever before in the 2000s. Gonorrhoea strains continue to have a high level of resistance to fluoroquinolones.
- The majority of HIV infections were acquired through sexual contact.
- More than half of the HIV cases were foreigners.

CHLAMYDIA (CHLAMYDIA TRACHOMATIS)

In 2011, 13,662 cases of chlamydia were reported (257/100,000), which was about 800 cases more than in 2010; 59% of the patients were women. The highest incidences were reported on Åland (368/100,000) and in the hospital districts of Lapland (318/100,000) and Helsinki and Uusimaa (306/100,000). The majority of cases were in the age group of 15 to 24 for women (73%) and 20 to 29 for men (67%). Patients under the age of 20 accounted for 32% of the women (2,608) and 13% of the men (743).

Ordinary chlamydia, spread through sexual contact, is caused by *Chlamydia trachomatis* immunotypes B and D-K. Immunotypes L1–3 cause lymphogranuloma venereum (LGV), known in Finland as early as in the 1940s under the now obsolete name neekerisankkeri, literally 'negro chancre'. LGV infections contracted through sexual contact between men have been reported in several European countries in recent years. Proctitis caused by LGV was found in three men in Finland in 2011. LGV can be typed from a *C. trachomatis* DNA-positive sample.

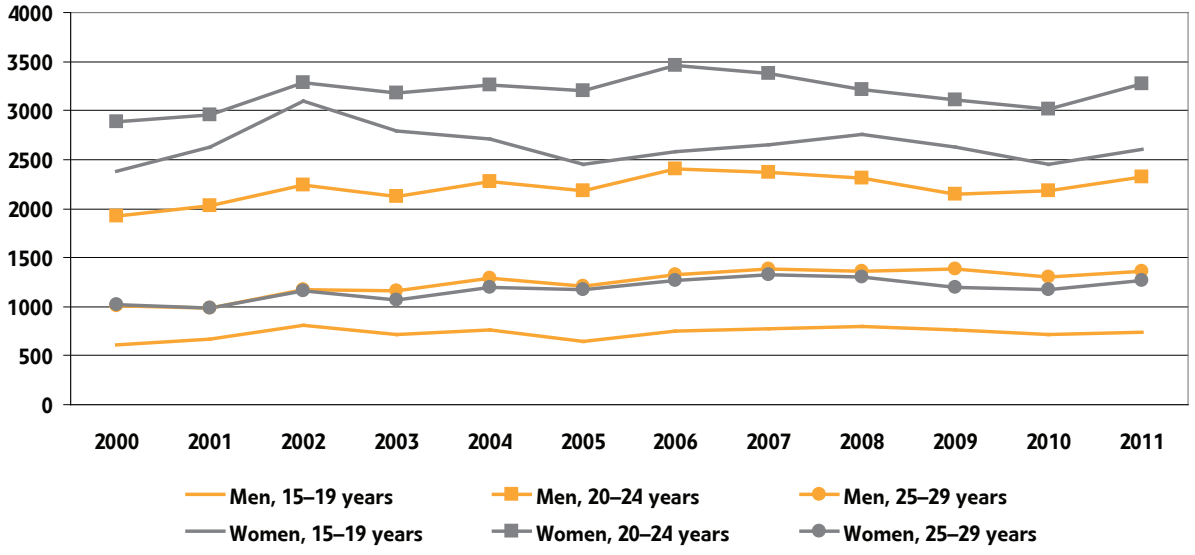

Figure 14. Chlamydia cases in the young adult age groups, 2000–2011 (no. of cases).

Table 3. Gonorrhoea infections acquired domestically and abroad, 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Finland	129	113	100	89	133	133	112	79	90	115	123	106
Thailand	18	17	31	27	38	30	42	44	34	36	45	35
Estonia	7	3	5	2	6	1	-	2	-	-	3	8
Russia	48	34	28	9	7	23	12	6	17	8	8	6
Other	32	26	18	21	21	20	25	22	24	40	33	41
Unknown	50	54	53	41	47	33	45	42	35	40	45	92
Total	284	247	235	189	252	240	236	195	200	239	257	288

Table 4. Syphilis infections acquired domestically and abroad, 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Finland	54	32	25	30	22	25	21	56	57	69	36	29
Russia	80	49	22	18	16	22	18	17	26	18	26	22
Thailand	1	1	-	1	2	1	1	2	6	5	4	5
Estonia	3	2	1	6	1	6	3	4	9	3	9	4
Other	17	12	14	16	12	21	20	29	43	40	50	45
Unknown	49	63	67	62	58	68	67	79	75	67	84	74
Total	204	159	129	133	111	143	130	187	216	202	209	179

GONORRHOEA (NEISSERIA GONORRHOEAE)

In 2011, more cases of gonorrhoea were reported than in any earlier year in the 2000s: the number of cases was 288 (5.4/100,000). Men accounted for 70% of the cases, and half of the cases were in the age group of 15 to 29. The mode of transmission was specified in 72% of the cases; one in three infections were contracted through sexual contact between men. The highest incidences were reported in the hospital district of Helsinki and Uusimaa (11.8/100,000), on Åland (7.3/100,000) and in the hospital district of Eastern Savo. The country of acquisition was specified in 68% of the cases; 46% of the infections had been acquired abroad. The most common country of origin was Thailand (35 cases) (Table 3). *Neisseria gonorrhoeae* strains continue to have a high level of resistance to fluoroquinolones. In 2010, 57% of gonococcal strains were found to be resistant to ciprofloxacin (Finres 2010). This showed a slight improvement on 2009 (72%).

SYPHILIS (TREPONEMA PALLIDUM)

In 2011, the number of syphilis cases reported totalled 179 (3.4/100,000), which was 40 fewer than in 2010 (209). Men accounted for 60% of the cases, and nearly half of the patients were in the age group 30 to 44. The mode of transmission was given in only 38% of the cases; of these, 45% involved sexual contact between men. The incidence was highest in the hospital districts of Southern Karelia (12.5/100,000), Helsinki and Uusimaa (5.6/100,000), and Kymenlaakso (5.0/100,000). The country of acquisition was specified in 59% of the cases, and of these 72% were acquired abroad, most often in Russia (22 cases).

HIV AND AIDS

In 2011, 176 new HIV infections were reported to the NIDR, 64% of the patients being men and 36% women. The majority of patients (56%) were foreigners. The majority of HIV infections were acquired through sexual contact: 49% through heterosexual contact and 21% through male homosexual contact. There were only 9 cases of infection through intravenous injection (5%), and for 23% of the cases the mode of transmission was not reported.

The number of infections in 2011 was about the same as in the two previous years. By the end of the year, the total number of new HIV infections ever reported in Finland was 2,952. The number of HIV findings has increased due to a growth in infections transmitted through heterosexual and male homosexual contact. By contrast, transmission through intravenous drug use has remained at a low level.

The number of infections from heterosexual contact in 2011 was 87, accounting for nearly half of all new cases. About three out of five patients (49) were foreigners. The foreigners had contracted the infection abroad (with one exception), usually in their home country. A significant number of Finnish patients, two out of three, had also contracted the infection abroad (excluding the cases where the country of acquisition is not known). The number of infections from heterosexual contact has been steadily growing throughout the history of the epidemic, among both foreigners and Finns.

The number of infections from homosexual contact between men in 2011 was 36. The majority (86%) of these patients were Finnish. About half of the Finns had contracted the infection in Finland and half abroad (excluding the cases where the country of acquisition is not known). Infections from homosexual contact between men began to increase again at the beginning of the 2000s and peaked at 72 new infections in 2007. Since then, the annual number of new infections has been about 40. The incidence of HIV in this group is significantly higher than in the general population.

There were 9 cases of HIV associated with intravenous drug use in 2011, 2 Finns and 7 foreigners. The foreigners had contracted the infection abroad. Effective preventive measures have kept infections from intravenous drug use at a low level following the HIV epidemic at the turn of the millennium.

One case of mother-child infection was reported in 2011; this child had been born abroad. A total of 14 mother-child HIV infections have been found in Finland in the 2000s, all but one of them of foreign origin. Mother-child transmission can be effectively prevented with medication during pregnancy.

In 2011, there were 3 reported cases of HIV infection possibly caused by a blood transfusion. The transfusion had been performed abroad. There have been no reported cases of infection through blood products in Finland since HIV testing of donated blood began in 1985.

In 2011, the mode of transmission was not reported in 23% of the cases. In nearly 90% of these 'not known' cases the patient was a foreigner, and the principal reason for the lack of data was the absence of a physician's report. A physician's report was lacking in 23% of the cases involving foreign patients and in 3% of the cases involving Finnish patients.

A record number of HIV infections were found in foreigners in Finland in 2011 (99). For the first time ever, foreigners outnumbered Finns among new HIV cases. The foreign patients were of more than 30 nationalities, mostly from countries of origin where

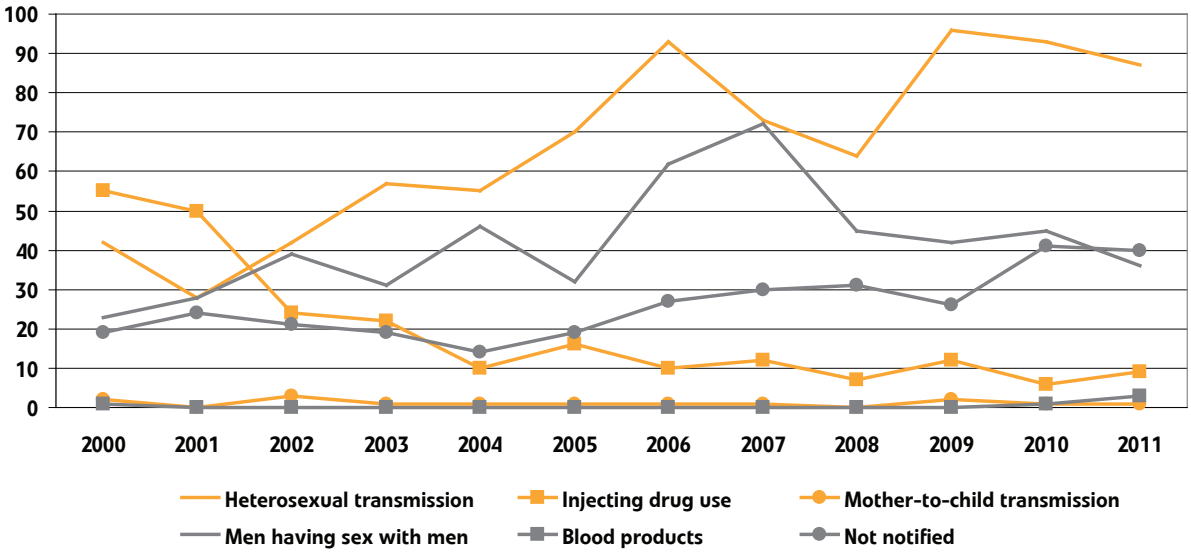

Figure 15. HIV cases by transmission group, 2000–2011 (no. of cases).

the incidence of HIV is high. The principal mode of transmission was a heterosexual contact.

In 2011, 24 cases of AIDS were diagnosed, 17 of them in Finns and 7 in foreigners. AIDS was the cause of death in 5 cases. There have been no significant changes in the number of AIDS cases and AIDS-induced deaths after the mid-1990s, when efficient combination medicines were introduced. By the end of 2011, 299 persons in all had died from AIDS in Finland.

As in early years, the percentage of late detection of infections was high. In 2011, infection was detected late in about half of the cases (CD4 < 350). The late detection percentage was about the same among both Finns and foreigners. Late diagnosis weakens the treatment prognosis and increases the possibility of further infections. Changes in primary resistance were found in 4% of the HIV virus strain samples in 2011, which by European standards is low.

Antimicrobial resistance

- There were more MRSA blood culture findings than in the previous year.
- VRE findings increased in northern Finland.
- There were more ESBL blood culture findings than in 2010.

MRSA

In 2011, 1,327 cases of methicillin-resistant *Staphylococcus aureus* (MRSA) were reported to the NIDR, about the same number as in the year before (2010: 1,267). Of these, 25% (2009–2010: 22–24%), were diagnosed only from samples taken from the nose or the nostrils. There were more MRSA blood culture findings than in the previous year (2011: 42; 2010: 26). Of these MRSA blood culture findings, 22 (52%) were in the Pirkanmaa hospital district (4.5/100,000) and 8 (19%) in the hospital district of Helsinki and Uusimaa (0.5/100,000). The other hospital districts reported zero to three cases each, totalling 12. Most (30 out of 42) of the invasive cases occurred in patients older than 65, and 2 in children. As earlier, the hospital districts of Pirkanmaa and of Helsinki and Uusimaa reported the highest total figures. The incidence per 100,000 inhabitants was highest in the hospital districts of Pirkanmaa, Western Bothnia and Northern Karelia. The percentage of findings in patients aged over 75 was 44%, similar to the figure for the previous year. The number of MRSA cases in children remained stable (94).

An MRSA strain isolated from the blood was typed in more than 1,350 individuals. There were 160 different *spa* types in the MRSA strains (2010: 165). The most common *spa* types were the same as in the previous year: t067 28% (2010: 28%), t172 18% (14%), t008 8% (9%), t002 4% (4%) and t032 3% (3%).

t067 was found in five hospital districts, most commonly in Pirkanmaa, and t172 was found in 18 hospital districts.

As in previous years, the t008 and t002 strains were also typed using pulse field gel electrophoresis (PFGE). Both were divided into several PFGE types. More than a third (37%) of the t008 strains were of PFGE type FIN-25, an internationally known strain of MRSA originating in outpatient care (USA 300), and one out of five (18%) were of PFGE type FIN-7.

Local clusters (MRSA strain isolated in more than 10 patients) also occurred in the hospital districts of Kymenlaakso (t223), Northern Karelia (t267, t034, t721), Pirkanmaa (t1012) and Western Bothnia (t2099).

The most common *spa* type among patients over 75 was t067 (37%; 2010: 39%). The most common *spa* types among children under the age of 16 were t172 (19%), t223 (11%) and t002 (9%), mostly of PFGE type FIN-16). In 2010 too, the most common *spa* types among children were t223 (18%) and t172 (9%), along with t008 (12%).

An MRSA strain isolated from the blood was typed in 31 individuals. The two most common *spa* types were also the most commonly found in blood cultures. *Spa* type t067 was found in 12 samples and t172 in 8, the rest (11 out of 31) representing 10 different *spa* types.

VRE

In 2011, the number of vancomycin-resistant enterococcus (VRE) findings reported to the NIDR increased on the previous year (2011: 128; 2010: 92). Most of the findings were reported by the hospital districts of Western Bothnia, Northern Bothnia and Lapland (100 out of 128); the majority of the patients were men (76 out of 128); and the largest age group was those over 75 (58 out of 128). In other hospital districts, the number of findings varied from 0 to 9. Four of the findings were from blood.

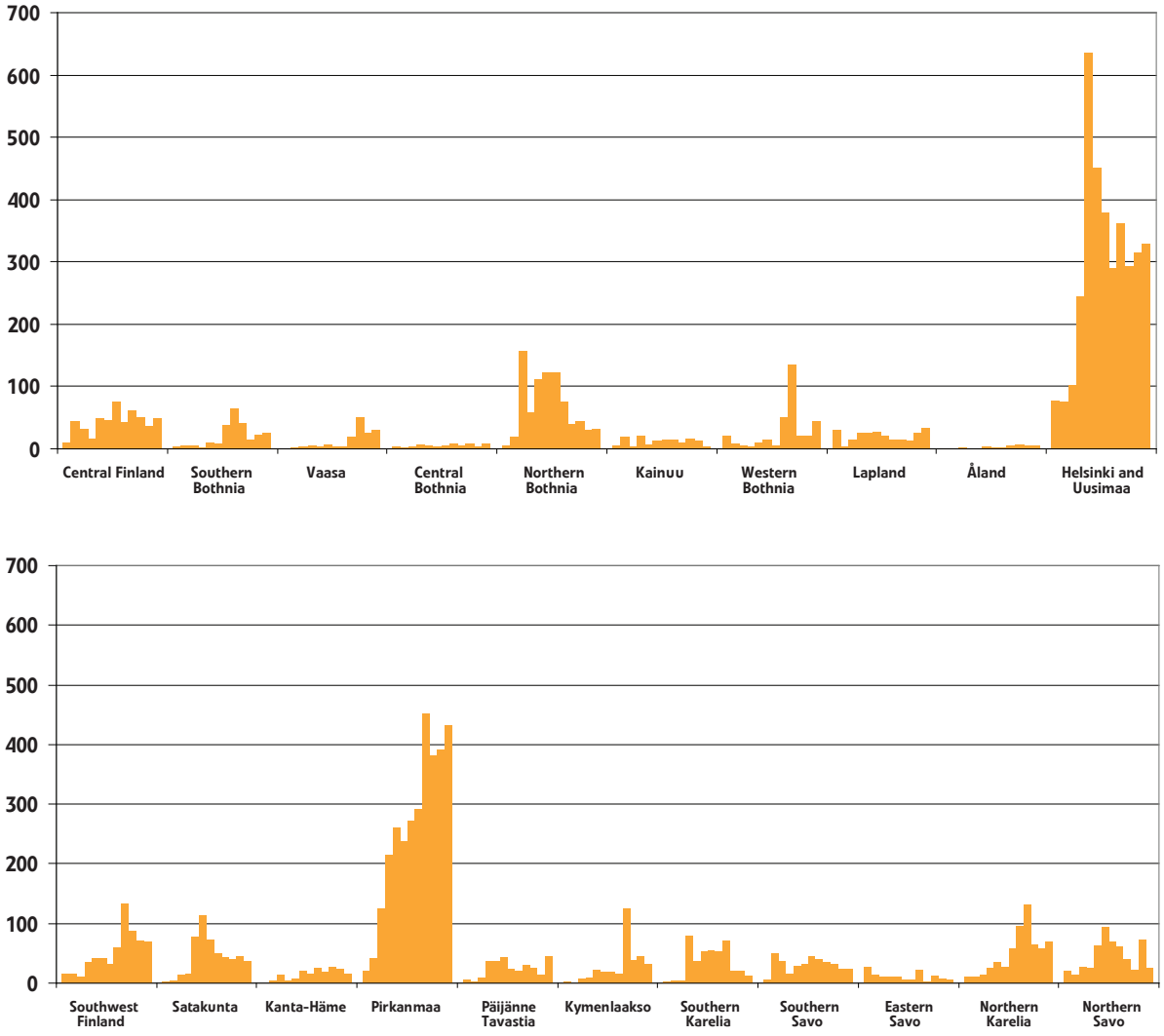

Figure 16a and 16b. MRSA cases by hospital district, 2000–2011 (no. of cases).

VRE findings were typed in 123 individuals. All findings except for two were of the *E. faecium* species, and most of these were of the *van*B type (116 out of 121). PFGE revealed that a new epidemic strain, VRE X, was spreading in the hospital districts of Western Bothnia, Northern Bothnia and Lapland, and this was eventually the most common type of strain in 2011 (85 out of 123 cases). VRE XI was the cause of 9 cases in 2011, of which were in the Northern Bothnia hospital district. Both epidemic strains were also identified using multilocus sequence typing (MLST); their sequence types – ST117 (VRE X) and ST17 (VRE XI) – belong to the *E. faecium* CC-17 clone, which is internationally known as spreading in hospitals. Only two cases of the VRE VIII strain, which had spread in the hospital district of Southwest Finland in 2010, were found in 2011. The remaining 28 out of 123 cases involved isolated unique findings (26 out of 123) or findings of VRE XII (2 out of 123).

ESBL

Since the beginning of 2008, third-generation *Escherichia coli* and *Klebsiella pneumoniae* exhibiting reduced susceptibility or resistance to cephalosporin (I for intermediate and R for resistant, respectively) have been reported to the NIDR. The majority of these bacteria are enzyme-producing ESBL strains and extended-spectrum cephalosporins that split penicillin.

In 2011, the majority of ESBL findings (3,119) were *E. coli* (2010: 2,528), with a small number (244) of *Klebsiella pneumoniae* (2010: 184). ESBL in *E. coli* was diagnosed in all age groups – almost 75% in women and over half in patients aged 65 years or more. The majority of diagnoses (72%, 2,238 out of 3,119) were made from urine. The largest number of cases was found in the hospital district of Helsinki

Table 5. MRSA-findings and their percentage of S. aureus blood culture findings, 1995–2011 (no. of cases and %).

	All MRSA findings	S. aureus blood culture findings	MRSA blood culture findings and the methicillin resistance of S. aureus (%)
1995	89	627	2 (0,3)
1996	110	667	0 (0,0)
1997	121	747	4 (0,5)
1998	190	719	5 (0,7)
1999	212	813	8 (1,0)
2000	266	850	4 (0,5)
2001	340	887	4 (0,5)
2002	600	989	9 (0,9)
2003	859	981	7 (0,7)
2004	1478	1059	30 (2,8)
2005	1381	1013	27 (2,7)
2006	1330	1239	37 (3,0)
2007	1297	1179	32 (2,7)
2008	1772	1261	40 (3,2)
2009	1267	1288	30 (2,3)
2010	1267	1370	26 (1,9)
2011	1327	1487	42 (2,8)
Total	13906	17176	307 (1,8)

Table 6. Antimicrobial resistance of Streptococcus pneumoniae in blood and cerebrospinal fluid culture findings, 1998–2011 (no. of cases and %).

	Cases reported to the NIDR	Studied strains	Erythromycin (R) (%)	Penicillin (I+R) (%)	Multidrug resistance (%)
1998	561	84	3,6	0	0
1999	568	471	5,9	7,2	0
2000	601	439	8,0	3,7	1,4
2001	658	360	18,8	7,5	5,0
2002	599	594	16,3	8,0	3,7
2003	721	739	21,9	12,7	5,7
2004	748	748	20,5	9,6	3,7
2005	735	731	20,5	9,6	4,4
2006	741	760	27,9	16,4	5,4
2007	788	794	23,2	14,4	3,5
2008	924	930	24,5	17,7	3,4
2009	854	848	28,4	19,9	4,7
2010	827	819	28,6	23,4	1,7
2011	779	780	26,8	21,9	2,8

I – reduced susceptibility: R – resistant; Multidrug resistance – strains simultaneously resistant to penicillin (I+R), erythromycin (R) and tetracycline (R)

and Uusimaa (991, 65/100,000), but the incidence was highest in the Central Finland and Western Bothnia hospital districts (90 and 89/100,000, respectively). There were considerably more ESBL findings in blood than in 2010 (150 vs. 112) (ESBL percentage of *E. coli* blood culture findings was 4.3%, or 150 out of 3,473, as opposed to 3.5% in 2010). The majority of the findings were made in the hospital district of Helsinki and Uusimaa. However, the incidence in blood findings was highest in the Lapland, Central Finland and Northern Karelia hospital districts.

Over half of the ESBL cases reported that involved *K. pneumoniae* were also diagnosed in patients aged 65 years or over, but the percentage of women was smaller than with *E. coli*, being 62%. The majority of diagnoses (62%, 151 out of 244) were made from urine. The largest number of cases was recorded in the hospital districts of Helsinki and Uusimaa (66) and Northern Bothnia (52), while the incidence was highest in the Western Bothnia and Northern Bothnia hospital districts. There were 16 blood findings (2010: 16) (percentage of ESBL in *K. pneumoniae* blood cultures was 3.6%, or 16 out of 449, as opposed to 3.2% in 2010).

Strains producing ESBL and carbapenemase

In 2011, genes encoding extended-spectrum beta-lactamases (ESBL) were specified in 203 bacterial strains. The strains had been collected for epidemic control or confirmation of third-generation cephalosporin-resistance. The figure includes 133 *E. coli* and 34 *K. pneumoniae* strains. Out of the *E. coli* and *K. pneumoniae* strains isolated in 2011, 61% and 42%, respectively, had an extended-spectrum beta-lactamase of the CTX-M group.

In 2011, carbapenemase-coding genes in 149 species of the *Enterobacteriaceae* genus were investigated. These strains had been sent for carbapenemase gene studies because of their reduced susceptibility to carbapenems. Of the strains examined, 12 had a carbapenemase gene: NMC-A, OXA-48/181, NDM or VIM. Carbapenemase genes were found in strains of *E. coli, K. pneumoniae* and *Enterobacter cloacae.* The sequence types of these strains varied.

The change from 2010 was that OXA-48/181 was now the most common finding, being found in strains of both *E. coli* and *K. pneumoniae.* Seven of the patients had had contact with a hospital abroad or had been travelling abroad. Foreign contact could not be established for all patients, however.

In addition to the species in the genus *Enterobacteriaceae,* 152 strains of *Acinetobacter baumannii* and *Pseudomonas aeruginosa* were examined for carbapenemase genes because of their reduced susceptibility to carbapenems. The PCR test found a positive result in 14% of the cases. *A. baumannii* had genes of the OXA group which are typical for it (OXA-51, OXA-58, OXA-24 and OXA-23). *P. aeruginosa* strains were found to have metallo-beta-lactamase genes VIM and IMP. Patients from whom a strain of *P. aeruginosa* with the VIM carbapenemase gene was isolated had

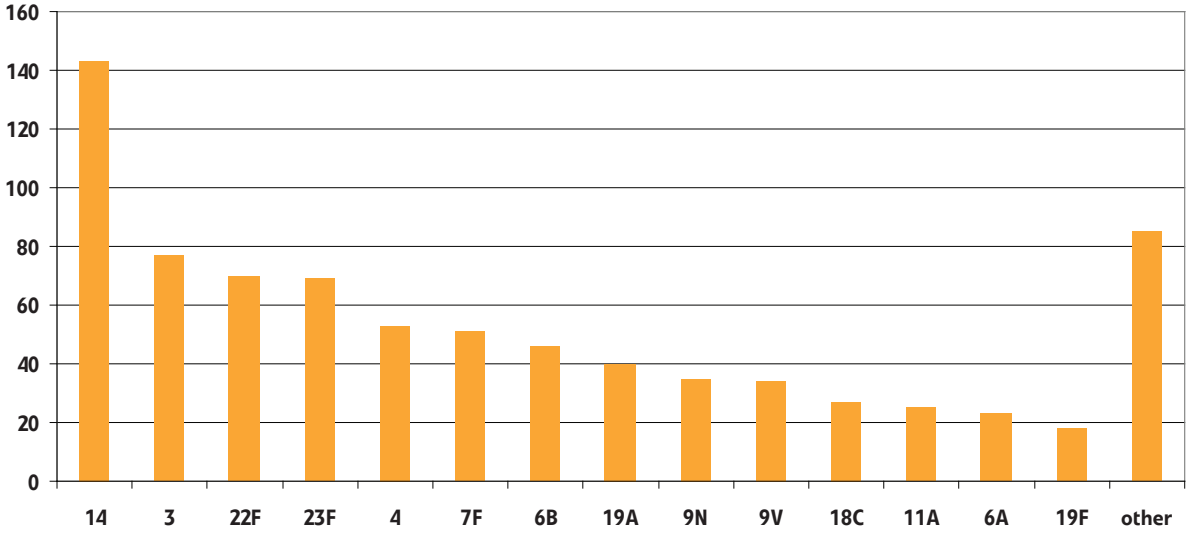

Figure 17. Streptococcus pneumoniae findings in blood and cerebrospinal fluid culture by serotype, 2011 (no. of cases).

had contact with a hospital abroad. No similar link to hospitals abroad could be established for strains with the IMP gene. This means that strains with IMP metallo-beta-lactamase may already be present in Finnish hospitals. There was no change compared with 2010.

A major percentage of bacterial strains with carbapenemase is thus of foreign origin, but more strains of Finnish origin were found than before. However, no local epidemics have been noted as yet.

INVASIVE PNEUMOCOCCAL DISEASE (STREPTOCOCCUS PNEUMONIAE)

In 2011, 779 cases (14/100,000) of invasive pneumococcal disease were reported (2010: 827, 15/100,000). As in previous years, the incidence was higher among men than among women (17 vs. 12/100,000). Regional variation was significant (7–26/100,000), which may be due to differences in how actively samples were taken.

In 2011, 796 strains of invasive pneumococcus were serotyped. Only small changes in the serotype distribution compared with 2010 were found; the most common serotype is still 14, which accounted for 18% of all strains serotyped.

In 2011, the antimicrobial susceptibility of 780 pneumococcal strains isolated from invasive infections was analysed. Strains with reduced susceptibility to penicillin (MIC > 0.06 mg/L) accounted for 22% of the strains, and strains completely resistant to penicillin (MIC > 2 mg/L) accounted for 0.3%. The proportion of macrolide-resistant strains decreased slightly; 27% of invasive pneumococcal strains were resistant to erythromycin. Multiresistant strains (PEN IR-ERY R-TET R) accounted for 2.8% of the strains. No strains resistant to levofloxacin (MIC > 2 mg/L) or ceftriaxon (MIC > 2 mg/L) were found in 2011. What is important to note is that the 2011 report follows the European Committee on Antimicrobial Susceptibility Testing (EUCAST) breakpoints rather than the US Clinical and Laboratory Standards Institute (CLSI) breakpoints followed up to and including the 2010 report. Despite this, it may be noted the changes in the susceptibility of invasive pneumococcus strains when compared with 2010 findings were minor. The decrease in the number of penicillin-resistant strains was due to the breakpoint adjustment.

Tuberculosis

- As previously, the majority of cases of tuberculosis are found in elderly patients who contracted the infection in their youth.
- One out of four cases of tuberculosis are found among immigrants.
- The incidence of tuberculosis among children under the age of 5 has not increased since 2006, when the BCG vaccine was restricted to at-risk groups.

TUBERCULOSIS (MYCOBACTERIUM TUBERCULOSIS)

Tuberculosis surveillance

Between 1995 and 2006, the registered tuberculosis cases included all cases confirmed by culture, as reported by the laboratories. In addition, cases reported by a physician were included, but only if the diagnosis was based on histology or a case of pulmonary tuberculosis was confirmed by positive sputum staining for tuberculosis bacilli. Since 2007, Finland has followed the case definition of the European Union's infectious disease surveillance for tuberculosis: in addition to cases fulfilling the criteria mentioned above, the statistics also include cases in which a physician suspected tuberculosis on the basis of clinical evidence and decided to give full tuberculosis treatment even though the infection was not confirmed by microbiological tests or histology. The new criteria for compiling statistics did not affect the number of cases confirmed by laboratory tests or histology.

Incidence of tuberculosis 2011

In 2011, there were 326 (6.1/100,000) tuberculosis cases, which is one more than in 2010 (325, 6.0/100,000). Of the cases, 236 (72%) were pulmonary tuberculosis, and 86 (36%) of them were sputum staining-positive. There were 251 cases of tuberculosis confirmed by culture, seven fewer than in 2010 (258). According to physicians' reports, 14 patients (4%) had a previous history of tuberculosis diagnosed after 1950, when anti-tuberculosis medication became available.

The increase in the overall number of tuberculosis cases in Finland in 2007 and 2008 compared to 2006 can be explained by the introduction in 2007 of the broader EU definition of tuberculosis cases. The annual numbers of cases confirmed by culture are comparable throughout the surveillance period. The number of cases of pulmonary tuberculosis confirmed by culture and with positive sputum staining has remained stable since 2007 except for a spike in cases among foreigners in 2009.

The age distribution of tuberculosis cases was as follows: under 15 years, 11 cases (3%); 15 to 29, 49 cases (15%); 30 to 44, 35 cases (11%); 45 to 59, 43 cases (13%); 60 to 74, 90 cases (28%); and 75 or more, 98 cases (30%). Nearly 60% of all cases were over 60 years of age, and most of them were born in Finland; these cases involved a reactivation of a latent infection contracted decades ago. No increasing trend has been found in children aged under 5 after the change to the vaccination programme in 2006.

In 2011, there were 80 foreign cases (25%), i.e. either born abroad or in the absence of country of birth, citizenship other than Finnish. The age distribution of these was as follows: under 15 years, 4 cases (5%); 15 to 44, 64 cases (80%); 45 to 59, 5 cases (6%); and over 60, 7 cases (9%). Among these there were 49 cases (61%) of pulmonary tuberculosis and 31 cases (39%) of other forms of tuberculosis. Information on the patient's country of birth or citizenship was missing in 6 cases (2%).

In 6 (2%) of the tuberculosis cases reported in 2011, the patient also had an HIV infection. Three of these were new HIV infections reported in 2011, and three had been reported earlier. Four of the cases were foreign in origin.

Table 7. Incidence of tuberculosis and percentage of culture-confirmed cases in Finland, 1995–2011 (no. of cases and %).

	Pulmonary tuberculosis				Other tuberculosis		All cases			
	Cases	Cases /100,000	Cases with positive sputum smear	Cases with positive sputum smear /100,000	Cases	Cases /100,000	Cases	Cases /100,000	Culture-confirmed cases	Proportion of culture-confirmed cases (%)
1995	436	8,6	241	4,7	217	4,3	653	12,8	475	72,7
1996	442	8,6	232	4,5	193	3,8	635	12,4	513	80,8
1997	360	7,9	185	3,6	197	3,8	557	10,9	442	79,4
1998	397	7,7	203	3,9	213	4,1	610	11,9	494	81
1999	405	7,8	185	3,6	188	3,6	593	11,5	510	86
2000	376	7,3	227	4,4	171	3,3	547	10,6	460	84,1
2001	312	6	150	2,9	181	3,5	493	9,5	411	83,4
2002	299	5,8	136	2,6	175	3,4	474	9,1	392	82,7
2003	290	5,6	144	2,8	122	2,3	412	7,9	348	84,5
2004	233	4,5	128	2,5	103	2	336	6,4	291	86,6
2005	269	5,1	136	2,6	100	1,9	369	7	321	87
2006	212	4,0	101	1,9	83	1,6	295	5,6	270	91,5
2007	235	4,5	93	1,8	111	2,1	346	6,6	250	72,3
2008	222	4,2	109	2,1	124	2,3	346	6,5	247	71,4
2009	295	5,5	96	1,8	116	2,2	411	7,7	303	73,7
2010	242	4,5	88	1,6	83	1,5	325	6,0	258	79
2011	236	4,4	86	1,6	90	1,7	326	6,1	251	77

Table 8. Cases of tuberculosis in foreigners, 1995–2011 (no. of cases and %).

	Pulmonary tuberculosis		Other tuberculosis		All cases	
	Cases in foreigners	Proportion of foreigners (%)	Cases in foreigners	Proportion of foreigners (%)	Cases in foreigners	Proportion of foreigners (%)
1995	25	5,7	13	6	38	5,8
1996	17	3,8	24	12,4	41	6,5
1997	23	6,4	23	11,7	46	8,3
1998	26	6,5	31	14,6	57	9,3
1999	25	6,2	21	11,2	46	7,8
2000	29	7,7	16	9,4	45	8,2
2001	34	10,9	28	15,5	62	12,6
2002	23	7,7	24	13,7	47	9,9
2003	36	12,4	13	10,7	49	11,9
2004	22	9,4	20	19,4	42	12,5
2005	28	10,4	24	24	52	14,1
2006	30	14,2	22	26,5	52	17,6
2007	45	19,1	28	25,2	73	21,1
2008	31	14	22	17,7	53	15,3
2009	81	27,4	43	37,1	124	30,1
2010	72	30	32	39	104	32
2011	49	20,8	31	34,4	80	24,5

Tuberculosis typing findings 2011

All new *M. tuberculosis* strains were genotyped in 2011 using the internationally standardized spoligotyping and MIRU-VNTR methods. The use of genotyping in the investigation of contacts was clarified in a guide published in 2011 titled "Suositus tuberkuloosin kontaktiselvityksen toteuttamiseksi"[Recommendation for conducting investigations of contacts for tuberculosis].

Of the typed strains, 19% presented in clusters of 2–4 strains. Spoligotype SIT53 is very common in Finland and can be separated into several clusters using the MIRU-VNTR method. Three new SIT53 clusters were found in 2011 in addition to those found earlier. Three new cases emerged in the SIT53 cluster that had spread among socially marginalized people in the Tampere region. The total number of strains genotyped in this cluster at the National Institute for Health and Welfare is 24.

Five new cases were added to the SIT914 cluster associated with hospital environments, bringing the total to 16 cases. Three new cases were added to the SIT40 cluster in Tammisaari and two new cases to the Jazz cluster (SIT42). Also, two new SIT42 clusters were found using the MIRU-VNTR method. One new strain each was added to the already known clusters in Pirkkala (SIT49), in Satakunta (SIT262) and among young immigrants (F404).

One case of laboratory contamination was found by typing. Also two cases caused by species of tuberculosis bacteria belonging to the *M. tuberculosis* complex that are rare in Finland (*M. bovis* and *M. africanum*) were found.

Tuberculosis strain susceptibility in 2011

The susceptibility of *Mycobacterium tuberculosis* strains in Finland remains good. Of all cultured strains, 94% had full susceptibility; in five cases, the pathogen was a multiresistant strain (MDR), and two of these were found in cases of Finnish origin.

Tuberculosis outcome surveillance in 2007–2010

Table 9 shows the distribution of treatment outcomes between 2007 and 2010. The surveillance covers cases of pulmonary tuberculosis confirmed by culture, nucleic acid detection or mycobacterial staining. Cases where the pathogen is an MDR strain are reported separately and are not included in Table 9. The outcome evaluation is performed 12 months after the case is registered. Some of the outcome evaluation forms for 2010 have not yet been returned, because of which the data is not as comprehensive as in previous years.

The preliminary figures for 2010 show that the outcome was good in 73% of cases, roughly the same figure as in previous years. It falls clearly short of the international target set by the WHO at 85% but is on a par with the average for EU Member States.

The mortality rate (before starting treatment or during treatment) was 9% in 2010, clearly lower than in previous surveillance years.

Table 9. Results of treatment outcomes in microbiologically confirmed pulmonary tuberculosis, 2007–2010 (no. of cases and %).

	2007	2008	2009	2010
Cases under surveillance	200	191	241	197
TREATMENT OUTCOME				
Favourable	144 (72 %)	140 (73 %)	167 (69 %)	143 (73 %)
Cured	85	89	84	90
Treatment completed	59	51	83	53
Non-favourable	41 (21 %)	37 (19 %)	44 (18 %)	21 (11 %)
Deceased	38 (19 %)	33 (17 %)	41 (17 %)	17 (9 %)
Treatment failure	1	1	0	0
Interrupted treatment	2	3	3	4
Missing	15 (7 %)	14 (7 %)	30 (12 %)	33 (17 %)
Transfer	2	2	13	5
Treatment continues at 12 months	7	9	9	9
Notified, as not known	1	3	2	2
Notification missing	5	0	6	17

Other infections

- There was a considerably larger number of cases of measles than in previous years. Most of these were cases imported from Europe.
- There were more cases of tick-borne encephalitis than ever before.
- Another record high was noted in borreliosis incidence.
- Most of the year's malaria infections were contracted in Africa.
- Dengue fever cases have been on the increase in recent years.
- The number of adult blood cultures continued to grow.

HAEMOPHILUS (HAEMOPHILUS INFLUENZAE)

In 2011, there were 66 reported infections caused by the *Haemophilus influenzae* bacterium, diagnosed in blood or CSF, more than half as many again as in the previous year. The majority of these (88%) were caused by unencapsulated strains of *Haemophilus influenzae*. Serotype b caused an illness in two adults and two children, aged 4 and 11. The adults were in an age group for which the Hib vaccination was not yet included in the vaccination programme in their childhood. The younger of the two children had not received the Hib vaccine at all, and the older one had not had the Hib vaccination booster shot that should have been given in the second year of life. Children born in 1985 or later have received the Hib vaccine at the child care clinic. Since the beginning of 2005, under the revised vaccination programme, the Hib vaccination is administered as a component of a combination vaccine at 3, 5, and 12 months. The efficiency of the vaccination is monitored, and vaccination data are investigated for all children diagnosed with Hib.

MENINGOCOCCUS (NEISSERIA MENINGITIDIS)

In 2011, the number of meningococcus infections detected in blood or CSF totalled 34 (0.63/100,000), which is about the same as in the previous three years. The number and percentage of group Y cases decreased to about half of what they were in the previous year (Table 10).

19 of the cases (56%) were caused by group B meningococcus and 7 cases (21%) by group Y. There were 6 cases (18%) caused by group C. The age distribution of the cases was much the same as in previous years: 5 patients aged 0 to 4, 2 patients aged 5 to 14, 7 patients aged 15 to 19 and 20 patients aged 20 or over. The incidence of the type B:P1.7-2,4:F1-5 strain that has been causing outbreak clusters in Germany, was higher than in the previous year (2011: 10 cases; 2010: 3 cases). The group Y strains belonged to four different types. No temporal or local clusters were detected.

In isolated cases of meningococcus, all persons in close contact with the patient except for health care personnel should be given prophylactic medication and also a vaccination if infection from that strain can be prevented by vaccination. Finland has vaccines against meningococcus serogroups A, C, W135 and Y.

MMR DISEASES (MEASLES, MUMPS, RUBELLA)

There was a considerably larger number of cases of measles in 2011 than in previous years. The number of cases was 27, most of them in the Helsinki Metropolitan Area. The disease was imported from Europe, particularly France, where the disease has had a high incidence since 2010. However, the majority of the infections in 2011 were contracted in Finland as a result of someone arriving from abroad with the disease, e.g. in the family or through other close contact;

Table 10. Meningococcal infections by serogroup, 2000–2011 (no. of cases).

	Group A	Group B	Group C	Group Y	Group W135	Unknown	Total
2000	0	30	11	2	3	2	48
2001	0	34	9	4	1	3	51
2002	0	36	6	4	1	2	49
2003	0	28	5	6	0	2	41
2004	0	29	5	4	2	4	44
2005	0	33	1	3	0	3	40
2006	0	38	5	1	0	1	45
2007	0	29	8	5	0	1	43
2008	0	19	8	2	0	0	29
2009	0	24	3	5	0	1	33
2010	0	14	4	13	1	3	35
2011	0	19	6	7	1	1	34

however, the source of infection could not be definitely established in all cases. Of those who contracted measles, 8 were under the age of 4, 3 were teenagers and the rest were adults. The majority of them had not been vaccinated, either because of their age or because of other reasons. However, a few patients who had received one or two doses of the MMR vaccine also contracted measles. Unvaccinated patients presented with typical measles symptoms, but vaccinated patients generally presented with very mild or atypical symptoms.

The measles viruses that caused the isolated cases early in the year were of the subtypes G3 and D8, but all the other typed viruses were of genotype D4, which was very common in Europe in 2010 and 2011. Laboratory tests on the cases of measles indicated that some of the cases would not have been detected if only one serum sample had been tested. To confirm a diagnosis of measles, it is important to take not only a serum sample but also saliva sample, throat swab and urine samples for PCR testing and virus characterization.

Two unvaccinated adults contracted mumps in 2011; the source of the infections is not known.

Rubella was imported to Finland from Vietnam in 2011. Two unvaccinated adults had contracted the disease during a trip to Vietnam. Also, one case of congenital rubella syndrome (CRS) was found in 2011. The mother had had rubella while pregnant in Vietnam before moving to Finland. It had been 25 years since the previous CRS diagnosis recorded in Finland.

PUUMALA VIRUS

In 2011, 1,833 cases of Puumala virus were reported (34/100,000), some 400 cases more than in 2010 but clearly fewer than in the record year 2008 (more than 3,200). The number of cases varies, depending on the virus reservoir, i.e. the size of the bank vole population. The variation usually follows a three-year cycle such that two abundant years are followed by a quieter year. Earlier peaks in epidemic nepropathy occurred in 2002, 2005 and 2008, so a higher incidence was expected in the previous year. The patients' age and gender distribution was the same as before. Of the patients, 59% were men, and most patients were of working age. There were 97 (5%) under 20 years of age. This time, the incidence was highest in the Eastern Savo hospital district (112/100,000 population) and the Southern Savo hospital district (109/100,000 population).

TICK-BORNE ENCEPHALITIS (TBE)

In 2011, 62 TBE antibody findings were reported to the NIDR, more than in any year before (2000–2010: 16 to 44 per year), however only 43 patients presented with symptoms consistent with the disease.

Findings positive for TBE were found between May and November, peaking in August. The patients' age range was 6 to 80. The patients included 8 people from Åland (all unvaccinated), 33 from elsewhere in Finland, one foreigner who contracted the disease on Åland and one Swedish national who contracted the disease in Sweden. In order to identify the place of acquisition, the National Institute for Health and

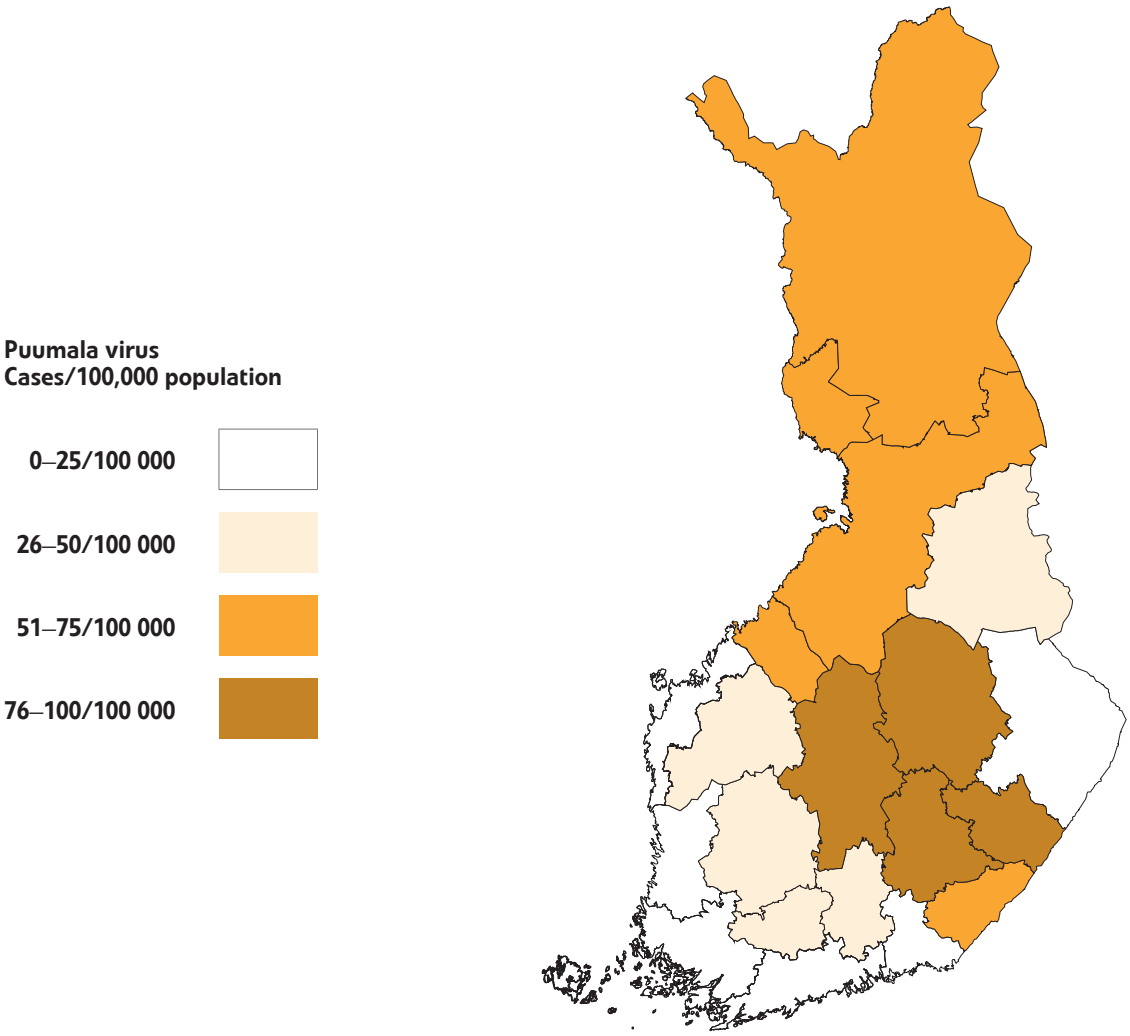

Figure 18. Cases of Puumala virus by hospital district, 2011 (no. of cases per 100,000 population).

Welfare interviewed patients who had been diagnosed with TBE in 2011 and/or studied their patient records. The distribution of places of acquisition was as follows: 13 (30%) in the Turku archipelago, 12 (28%) on Åland, 2 in Maalahti, 2 in the Kotka archipelago, 2 in the Sipoo archipelago, 2 on the shores around Helsinki, 1 in Lappeenranta, 1 in Länsi-Uusimaa, 1 in Simo and 1 near Outokumpu. Two Finnish nationals contracted the disease in Estonia, one in Russia and one in Sweden. In one case, the location of acquisition remained unclear.

If a patient falls ill with meningitis or encephalitis between May and October even though he or she has not noticed a tick bite, TBE should be suspected, especially if this happens in known high-risk areas. Because new endemic TBE regions may continue to emerge, it is a good idea to consider the possibility of TBE infection even beyond currently known risk areas.

TULAREMIA (FRANCISELLA TULARENSIS)

In 2011, 75 laboratory-confirmed cases of tularemia were reported (1.4/100,000), the highest number of cases (35) being reported in the Northern Bothnia hospital district as in the previous year. The incidence was highest in the Northern Bothnia (8.8/100,000), Southern Bothnia (5.5/100,000) and Central Bothnia (5.3/100,000) hospital districts. The age and gender distribution of the cases were similar to what they had been in earlier years. The patients were 5 to 91 years old (median: 49 years), and 63% of them were women. As is typical, the majority of the cases were diagnosed in August and September.

Tularemia is mainly transmitted by insect stings, which explains why the incidence of the disease peaks in late summer. In addition, tularemia bacteria

are easily transmitted by inhalation in aerosol form or through direct contact with an infected animal. The bacteria may also be transmitted through contaminated water or food. The incubation period for the disease is 3 to 5 days on average, and its clinical picture depends on the mode of transmission. The annual incidence of tularemia varies greatly (0.5 to 18/100,000 since 1995), and the epidemics that occur with a cycle of a few years tend to be local.

POGOSTA DISEASE (SINDBIS VIRUS)

In 2011, 63 cases were reported. The incidence was highest in the Southern Savo and Northern Karelia hospital districts, being 4.6/100,000 in both. The patients were 19 to 75 years old (median: 49 years), and 35 of them (56%) were women. The majority of the cases, 51 (81%), were diagnosed between July and September.

Sindbis virus is assumed to be transmitted mainly by insect stings. Temperatures in early summer and rainfall and snowfall in the previous winter significantly affect incidence. Waterway regulation, other local ecological and socioeconomic factors together with cyclical variation in available animal reservoirs (forest game birds) may also play a role. Cases of Pogosta disease tend to cluster in the period from late July to September. After the incubation period, which is less than one week, the disease causes a fever which may be associated with a rash and joint symptoms which may be long-term and last several years.

Pogosta disease has followed a regular seven-year cycle since 1974 except for 2009. The epidemic peaked in 1981, 1995 and 2002; in 2009, however, only 106 cases were found (2/100,000).

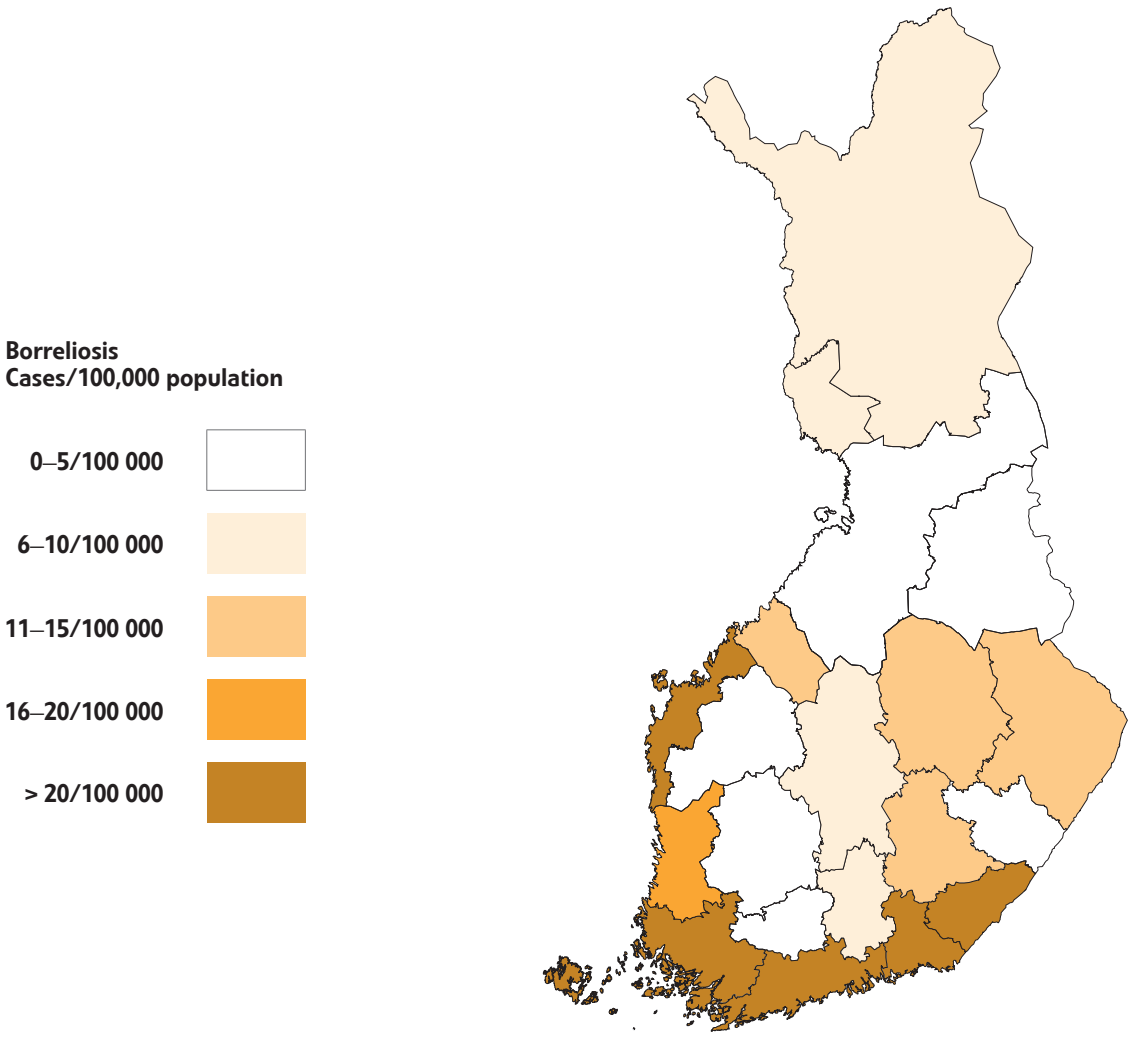

Figure 19. Cases of Borreliosis by hospital district, 2011 (no. of cases per 100,000 population).

BORRELIA (LYME DISEASE)

In 2011, the number of borrelia cases reported was 1,662, more than ever before. The previous record was 1,467 in 2009, the number of cases in 2010 being 1,442. The incidence in the whole country was 31/100,000 on average, but once again there was significant regional variation. As before, the incidence was highest on Åland (1,746/100,000), accounting for 30% of all diagnosed borrelia infections in Finland, 489 cases. As in previous years, the incidence of borrelia was highest in the autumn, from August to November. The majority of the patients (74%) were aged over 45; 53% of the patients were women.

RABIES

Doctors are required to report cases where risk assessment has led to the start of rabies vaccination treatment after exposure. In 2011, 57 suspected cases of rabies were reported to the NIDR. There were 35 patients who had been exposed during a trip abroad, 11 of them in Thailand. Some had been exposed in Indonesia, India, Russia and Lithuania, and there were some additional isolated cases. In most of the cases contracted abroad, exposure consisted of dog bites. Exposure in Finland was reported in 22 cases, half of them associated with bat contacts. Three cases of exposure to rabies vaccine bait were reported.

MALARIA

Malaria was diagnosed in 34 patients in Finland in 2011. There were 23 cases of *Plasmodium falciparum,* 8 cases of *P. vivax,* and 3 cases of *P. ovale.* The majority of the infections were contracted in Africa (26 cases, or 76%), 18 of them in western Africa. There were 4 infections acquired on the Indian subcontinent, 3 in South-East Asia and 1 in South America. Of the malaria patients, 7 were native Finns who had taken a trip of less than six months to a malaria region, and 2 were Finns residing in a malaria region. A further 17 (50%) were immigrants from a malaria region who had returned to visit their home country; 4 were immigrants who had fallen ill immediately after arriving in Finland. Four patients were visitors to Finland. The number of malaria cases and the risk groups remained approximately the same as in previous years.

Table 11. Malaria cases in Finland in 2011 by country of acquisition.

Continent	Country	Cases
Asia	India	3
	Indonesia	1
	Cambodia	1
	Malaysia	1
	Pakistan	1
	Total	7
Africa	Gambia	1
	Ghana	2
	Cameroon	5
	Kenya	3
	Congo	1
	Liberia	1
	Mozambique	1
	Nigeria	5
	Ivory Coast	1
	Sierra Leone	3
	Sudan	1
	Tanzania	2
	Total	26
America	Brazil	1
	Total	1
Total		**34**

DENGUE FEVER

Dengue fever cases have been on the increase in recent years, with 35 to 50 cases per year. In 2011, laboratories reported 45 findings.

OTHER TRAVEL-RELATED INFECTIONS

A significant percentage of the following infections are travel-related: legionella, salmonella, campylobacter, shigella, EHEC, hepatitis A, hepatitis B, gonorrhoea, syphilis, HIV and AIDS, carbapenem-resistant gram-negative bacilli and MMR diseases; the data on country of acquisition and means of transmission are discussed separately for each of the following in their respective sections.

BLOOD AND CSF FINDINGS IN CHILDREN

Blood culture findings in children

The number of blood culture positive cases in children under 15 reported in 2011 was 551, roughly the same as in recent years (average between 2000 and 2010 was 625, variation 530–687). Over half of the findings (296 out of 551) were in babies under 12 months old. Among infants, *Staphylococcus epidermidis* and other coagulase-negative staphylococci caused over 37% of blood culture positive infections. Though these bacteria belong to normal skin flora, they typically cause late-onset sepsis in newborn babies in intensive care.

The second most common cause (14% of the findings) was *Streptococcus agalactiae* (Group B streptococcus, GBS). It is typically contracted from the mother's birth canal during labour and causes an infection (early-onset sepsis) in the newborn baby during its first days of life. Other common causes of infection were *Escherichia coli* (16% of the findings), *Staphylococcus aureus* (7%), *Enterococcus faecalis* (4%) and *Streptococcus pneumoniae* (4%), as expected.

Coagulase-negative staphylococci and *S. pneumoniae* were the most common findings in children aged 1 to 14 (16% and 29%, respectively), accounting for half of the reported cases in this age group. These were followed by *S. aureus* (16%) and the *Streptococcus viridans* group (8%).

CSF findings in children

The number of bacterial and fungal findings related to children's central nervous system infections remained at the same level as in the preceding years, as did the distribution of pathogens. The number of cases reported in 2011 was 25 (annual average from 2000 to 2010 was 38, variation 18–56), of which 8 were diagnosed in infants under 12 months old. The most common findings in the age group of under 12 months were *S. agalactiae*, pneumococci and *S. epidermidis* (Table 14); in the age group 1 to 14, the most common findings were meningococci, pneumococci and *S. aureus.*

GBS in newborns

Between 1995 and 2011, an average of 33 cases per year of early-onset GBS in newborns (diagnosed from blood and/or CSF under the age of 7 days) were reported; the variation was 22 to 57 cases per year, and the incidence was 0.4 to 1.0 per 1,000 live births. There were 22 cases in 2011 (0.4 cases per 1,000 live births). The average figure for late-onset GBS between 1995 and 2011 was 15 cases per year; the variation was 6 to 24 cases per year, and the incidence was 0.1 to 0.4 per 1,000 live births. There were 20 cases in 2011 (0.3 cases per 1,000 live births).

Table 12. Blood culture findings in infants (under 12 months), 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Staphylococcus epidermidis	50	76	76	61	110	98	100	92	87	64	71	76
Escherichia coli	43	39	40	39	37	41	44	42	38	38	45	48
Streptococcus agalactiae	38	41	46	37	45	73	55	51	49	51	54	42
Staphylococcus, other coagulase-negative	26	23	35	20	36	31	41	39	33	43	32	33
Staphylococcus aureus	18	17	24	21	32	32	37	25	23	22	24	21
Enterococcus faecalis	4	6	11	11	9	15	22	8	5	10	20	12
Streptococcus pneumoniae	26	19	17	25	28	26	27	21	26	25	20	11
Streptococcus viridans group	6	10	8	13	15	12	10	9	8	9	18	11
Enterobacter species	6	6	6	6	5	3	13	8	6	3	3	10
Klebsiella species	9	8	7	8	9	9	8	6	8	9	3	7
Serratia species	3	0	5	2	4	0	2	3	4	1	2	4
Acinetobacter species	1	0	4	3	1	1	3	2	1	1	3	2
Bacillus	1	2	0	1	2	2	1	4	4	2	1	1
Enterococcus faecium	4	1	2	2	3	2	3	0	1	2	2	1
Haemophilus, other than influenzae	0	0	0	1	0	1	1	0	1	0	0	1
Neisseria meningitidis	8	3	2	2	5	3	2	3	3	5	4	1
Propionibacterium species	1	0	1	0	0	0	0	1	0	0	0	1
Pseudomonas aeruginosa	0	2	1	1	4	0	0	0	2	0	2	1
Salmonella, other than Typhi	0	0	1	0	0	0	0	0	0	1	0	1
Bacteroides fragilis group	1	1	0	0	0	0	0	1	1	0	1	0
Citrobacter species	4	2	1	1	0	1	1	0	0	1	1	0
Clostridium perfringens	0	0	1	0	0	1	0	0	0	0	0	0
Clostridium, other or unidentified	1	1	0	1	1	0	2	0	1	1	1	0
Enterococcus, other or unidentified	0	0	0	0	1	0	0	0	0	2	0	0
Haemophilus influenzae	2	3	0	2	1	2	1	1	2	2	1	0
Listeria monocytogenes	1	1	0	0	0	0	2	1	0	1	2	0

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Morganella morganii	1	0	0	0	0	0	0	0	0	0	0	0
Peptostreptococcus and Peptococcus	2	1	0	0	0	0	0	0	0	0	1	0
Prevotella species	0	0	0	0	0	0	0	0	1	0	0	0
Proteus mirabilis	0	0	0	0	1	0	1	1	0	0	0	0
Proteus vulgaris	1	0	0	0	0	0	0	0	0	0	0	0
Stenotrophomonas maltophilia	0	0	1	1	0	1	0	2	0	2	2	0
Streptococcus bovis group	1	0	1	1	1	1	0	0	0	2	0	0
Streptococcus milleri group	1	0	1	0	0	0	1	0	0	0	0	0
Streptococcus pyogenes	1	2	1	1	3	0	0	3	2	4	2	0
Streptococcus, other beta-haemolytic	1	0	1	1	2	0	1	0	0	3	2	0
Veillonella species	0	0	0	0	0	0	1	0	0	0	0	0
Other bacteria	4	4	12	9	8	4	5	10	7	5	4	10
Bacteria, total	265	268	305	270	363	359	384	333	313	309	321	294
Candida albicans	3	3	10	2	3	4	4	2	3	1	2	1
Other candida species	9	8	8	2	0	1	0	1	1	0	0	1
Other fungi	0	0	0	0	0	0	0	1	0	0	0	0
Fungi, total	12	11	18	4	3	5	4	4	4	1	2	2

Table 13. Blood culture findings in children (aged 1 to 14), 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Streptococcus pneumoniae	72	76	92	94	88	101	99	115	87	92	95	74
Staphylococcus aureus	44	38	58	47	58	41	37	43	40	36	43	42
Staphylococcus epidermidis	48	26	40	30	25	41	40	33	22	31	37	29
Streptococcus viridans group	18	23	13	13	18	24	24	23	21	25	36	20
Streptococcus pyogenes	9	9	10	12	4	0	9	13	11	11	6	16
Staphylococcus, other coagulase-negative	15	18	14	16	9	13	8	18	13	16	21	13
Escherichia coli	20	5	13	13	15	10	16	12	14	12	15	11
Haemophilus influenzae	2	2	1	5	0	2	1	2	3	3	2	5
Pseudomonas aeruginosa	6	7	4	6	3	6	3	2	1	3	7	4
Enterobacter species	2	0	1	6	3	3	1	2	4	3	2	3
Enterococcus faecalis	0	2	4	2	2	4	2	6	6	4	6	3
Bacillus	9	2	5	6	2	7	6	0	6	3	3	2
Bacteroides fragilis group	3	1	1	0	2	3	0	0	0	1	0	2
Klebsiella species	2	2	6	4	5	10	3	6	5	2	4	2
Neisseria meningitidis	9	9	8	6	2	7	5	3	4	0	6	2
Peptostreptococcus and Peptococcus	1	1	0	0	0	0	0	0	0	0	0	2
Salmonella Typhi	0	0	1	1	1	2	0	2	0	0	0	2
Salmonella, other than Typhi	1	1	1	1	1	1	2	5	2	0	6	2
Clostridium, other or unidentified	3	1	2	1	0	3	2	4	1	1	2	1
Fusobacterium species	4	1	3	0	1	2	3	5	5	1	1	1
Mycobacterium, other or unidentified	0	0	0	0	0	0	0	0	0	0	0	1
Streptococcus milleri group	2	1	1	0	0	3	2	0	2	2	2	1
Streptococcus, other beta-haemolytic	1	1	0	3	2	2	4	1	0	2	2	1
Acinetobacter species	5	5	8	2	1	4	1	2	2	4	1	0
Bacteroides, other than fragilis group	1	0	0	0	0	0	0	0	0	0	0	0
Campylobacter species	2	1	0	0	0	0	0	0	0	0	0	0

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Citrobacter species	1	1	1	0	0	1	0	2	2	1	1	0
Clostridium perfringens	0	0	0	1	0	0	1	2	0	1	1	0
Enterococcus faecium	2	2	4	1	2	2	3	4	2	7	7	0
Enterococcus, other or unidentified	0	0	0	2	2	0	2	2	3	0	1	0
Listeria monocytogenes	0	1	0	1	0	0	0	0	0	0	0	0
Prevotella species	0	0	0	0	1	0	0	0	0	0	0	0
Propionibacterium species	0	0	0	1	0	0	0	0	0	0	0	0
Proteus mirabilis	0	0	0	0	1	0	0	1	0	0	0	0
Pseudomonas, other than aeruginosa	1	3	1	1	0	1	0	1	0	3	0	0
Serratia species	0	0	1	0	0	1	2	1	0	0	1	0
Stenotrophomonas maltophilia	2	2	0	1	3	0	1	3	4	2	2	0
Streptococcus agalactiae	1	0	0	2	1	0	0	2	1	0	0	0
Streptococcus bovis group	0	0	0	0	0	0	1	0	0	0	0	0
Veillonella species	0	0	0	0	0	0	1	0	0	0	1	0
Yersinia pseudotuberculosis	0	0	0	1	0	0	0	0	0	0	0	0
Other bacteria	9	8	16	11	18	22	14	15	10	10	24	10
Bacteria, total	295	249	309	290	270	316	293	330	271	276	335	249
Other candida species	1	0	0	0	1	0	2	3	1	0	0	2
Candida albicans	4	1	2	1	0	1	1	0	2	0	2	0
Other fungi	0	0	1	2	0	0	2	1	0	0	0	1
Fungi, total	5	1	3	3	1	1	5	4	3	0	2	3

Table 14. Cerebrospinal fluid culture findings in infants (under 12 months), 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Staphylococcus epidermidis	0	1	3	3	3	3	3	2	1	2	2	2
Streptococcus agalactiae	4	2	5	1	10	7	7	6	3	6	8	2
Streptococcus pneumoniae	0	0	3	6	8	3	1	4	3	2	3	2
Escherichia coli	0	3	1	1	2	0	2	1	1	1	2	1
Streptococcus viridans group	0	0	0	1	0	0	0	0	0	2	0	1
Acinetobacter species	0	0	1	0	0	0	1	0	0	0	0	0
Bacillus	0	0	0	0	0	0	1	0	0	0	0	0
Bacteroides, other than fragilis group	0	0	0	0	0	0	0	1	0	0	0	0
Citrobacter species	0	0	0	0	0	0	0	1	0	0	1	0
Enterobacter species	0	0	0	0	1	0	0	0	0	0	0	0
Enterococcus faecalis	0	0	0	1	1	0	2	1	0	0	0	0
Enterococcus faecium	0	0	0	0	0	0	1	0	0	0	0	0
Haemophilus influenzae	1	1	0	1	0	1	0	0	0	1	0	0
Klebsiella species	0	0	0	0	0	0	0	0	0	1	0	0
Mycobacterium, other than avium	0	0	0	0	0	0	0	0	0	0	1	0
Neisseria meningitidis	5	4	1	2	4	0	1	2	1	2	1	0
Propionibacterium species	0	0	0	1	1	0	0	0	0	0	0	0
Serratia species	0	0	0	0	1	0	0	0	0	0	0	0
Staphylococcus aureus	1	0	0	3	2	1	0	1	2	2	1	0
Staphylococcus, other coagulase-negative	0	0	4	1	2	1	0	0	4	1	0	0
Streptococcus pyogenes	0	0	0	0	0	0	0	0	0	1	0	0
Other bacteria	0	0	2	1	1	0	0	0	0	1	0	0
Bacteria, total	11	11	20	22	36	16	19	19	15	22	19	8
Candida albicans	0	0	0	0	0	0	0	0	0	1	0	0
Fungi, total	0	0	0	0	0	0	0	0	0	1	0	0

Table 15. Cerebrospinal fluid culture findings in children (aged 1 to 14), 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Neisseria meningitidis	6	5	7	4	4	5	7	5	3	2	3	4
Streptococcus pneumoniae	0	0	2	10	2	1	5	5	2	4	2	3
Staphylococcus aureus	1	0	1	2	2	0	0	2	3	3	2	2
Staphylococcus epidermidis	0	0	7	1	4	2	0	1	5	2	1	2
Haemophilus influenzae	1	1	0	2	0	0	0	0	0	0	0	1
Propionibacterium species	0	0	0	0	0	1	0	0	0	0	0	1
Acinetobacter species	0	0	1	0	1	1	0	0	0	0	0	0
Bacteroides fragilis group	0	0	0	0	0	0	1	0	0	0	0	0
Citrobacter species	0	0	1	0	0	0	0	0	0	0	0	0
Corynebacterium species	0	0	0	0	0	0	0	0	2	0	1	0
Enterobacter species	0	0	0	0	1	0	0	0	0	1	0	0
Enterococcus faecalis	1	0	0	0	1	1	0	0	0	0	1	0
Enterococcus faecium	0	0	1	0	1	0	0	0	0	0	0	0
Escherichia coli	1	0	0	0	0	0	1	0	0	0	0	0
Mycobacterium, other than avium	0	0	0	1	0	0	0	0	0	0	0	0
Peptostreptococcus and Peptococcus	0	0	0	0	0	0	1	0	0	0	0	0
Staphylococcus, other coagulase-negative	0	0	3	2	2	2	0	0	0	1	0	0
Stenotrophomonas maltophilia	0	0	0	1	0	0	0	0	0	0	0	0
Streptococcus agalactiae	0	1	0	0	0	0	0	0	0	0	0	0
Streptococcus pyogenes	0	0	1	0	0	0	0	0	0	0	0	0
Streptococcus viridans group	0	0	0	1	1	0	2	0	0	0	0	0
Streptococcus, other beta-haemolytic	0	0	1	0	0	0	0	0	0	1	0	0
Other bacteria	0	0	5	0	0	5	1	0	6	3	1	4
Bacteria, total	10	7	30	24	19	18	18	13	21	17	11	17
Candida albicans	0	0	0	0	1	0	0	0	0	0	0	0
Fungi, total	0	0	0	0	1	0	0	0	0	0	0	0

BLOOD AND CSF FINDINGS IN ADULTS

Blood culture findings in adults

The total number of blood culture findings in adults has grown steadily and exceeded 11,000 in 2011 (2010: 10,874). Gram-positive bacteria were more common in the working-age population (aged 15 to 64) and gram-negative bacteria among those aged 65 or more. Anaerobic bacteria constituted 4% and fungi 2% of all blood culture positive findings among adults.

In the working-age population, the most common bacterial finding in 2011 was *Escherichia coli*, constituting more than 20% of all cases (Table 16). The next most common findings were *Staphylococcus aureus* (15%), *Streptococcus pneumoniae* (9%) coagulase-negative staphylococci (9%), and *Klebsiella* species (4%).

E. coli was also the most common blood culture finding among patients aged 65 years or more, accounting for a third of all findings (Table 17). The next most common findings were *Staphylococcus aureus* (11%), coagulase-negative staphylococci (7%), *Klebsiella* species (7%) and *Streptococcus pneumoniae* (4%).

CSF findings in adults

There were 131 reported cases of microbial findings in CSF in adults in 2011; the annual average for the period 2000 to 2010 was 144, variation 32–193. Patients over the age of 65 accounted for 27% of the cases (35 out of 131).

Coagulase-negative staphylococci were reported in 17% of the cases in working-age patients (Table 19). The most common actual pathogens were pneumococcus (13%), *S. aureus* (21%) and meningococcus (7%).

In patients aged 65 years or older, coagulase-negative staphylococci accounted for 14% of the findings (Table 20). The most commonly reported actual pathogens were pneumococcus (20%), *S. aureus* (14%), and *Listeria monocytogenes* (11%).

Group A streptococcus

The prevalent emm types of group A streptococcus (*Streptococcus pyogenes*) were *emm1, emm28* and *emm89*, as in previous years. The percentage of the previously common emm type *emm84* began to decline in 2008 and is now low (2%) (Table 18). Recently emerging emm types include *emm12* and *emm119*, of which *emm12* accounted for 10% of the cases and *emm119* for 4% (Table 18).

Table 16. Blood culture findings in patients aged 15 to 64, 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Escherichia coli	533	613	580	645	707	780	797	837	871	885	930	933
Staphylococcus aureus	409	451	462	448	488	459	565	549	529	540	585	645
Streptococcus pneumoniae	312	343	333	406	386	377	348	353	480	441	415	393
Staphylococcus epidermidis	278	300	305	286	294	286	281	265	279	313	264	223
Klebsiella species	115	114	134	121	159	184	145	159	198	187	207	163
Staphylococcus, other coagulase-negative	123	106	138	114	126	113	120	141	151	137	139	143
Streptococcus viridans group	119	118	105	126	141	141	130	118	140	144	150	139
Streptococcus, other beta-haemolytic	59	66	78	79	101	96	127	117	113	113	131	138
Bacteroides fragilis group	69	64	61	59	67	83	85	82	109	68	110	109
Enterococcus faecium	39	61	53	51	45	66	69	81	91	89	91	108
Streptococcus pyogenes	84	60	93	78	100	76	105	133	157	117	113	102
Enterococcus faecalis	67	95	99	84	80	100	83	105	83	107	86	97
Pseudomonas aeruginosa	79	72	73	85	58	88	62	72	74	78	91	92
Enterobacter species	75	92	53	60	62	49	77	70	69	82	99	86
Streptococcus milleri group	48	46	48	48	48	54	62	64	72	57	68	86
Streptococcus agalactiae	63	76	78	68	64	99	76	83	96	95	110	75
Bacillus	23	20	18	22	15	18	22	24	25	21	32	34
Salmonella, other than Typhi	21	37	12	22	35	29	51	59	48	26	42	33
Serratia species	8	10	12	14	10	16	18	19	24	27	20	32
Fusobacterium species	17	26	15	21	32	31	19	31	31	27	37	31
Peptostreptococcus and Peptococcus	15	20	22	23	15	21	18	11	12	27	15	30
Citrobacter species	19	18	14	10	21	15	28	19	23	29	31	28
Haemophilus influenzae	14	14	9	14	12	13	9	26	18	19	18	22
Acinetobacter species	18	9	13	10	16	16	10	21	13	18	14	21
Clostridium, other or unidentified	35	26	28	14	17	22	20	15	19	20	22	19
Capnocytophaga canimorsus	3	6	6	6	6	8	8	8	8	11	11	17
Neisseria meningitidis	13	19	20	18	18	16	20	21	9	13	14	17

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Proteus mirabilis	18	20	15	11	15	12	18	14	14	18	26	17
Prevotella species	6	11	4	11	11	15	11	8	13	13	15	16
Veillonella species	4	4	2	3	1	6	3	5	3	7	5	13
Enterococcus, other or unidentified	5	9	14	10	10	11	6	4	7	13	13	12
Propionibacterium species	20	19	8	11	6	9	7	5	3	9	6	9
Stenotrophomonas maltophilia	11	15	14	6	12	12	7	5	15	12	12	9
Clostridium perfringens	6	8	6	9	6	16	11	12	10	16	16	8
Morganella morganii	7	4	3	4	4	3	8	7	14	8	6	8
Bacteroides, other than fragilis group	2	6	5	0	5	2	4	3	5	10	1	7
Listeria monocytogenes	9	7	9	12	7	10	10	9	8	9	15	7
Pseudomonas, other than aeruginosa	2	2	3	4	5	4	0	4	9	7	7	7
Streptococcus bovis group	4	3	2	2	3	8	5	7	1	6	7	6
Campylobacter species	10	14	7	10	13	5	3	8	7	11	10	4
Haemophilus, other than influenzae	1	8	4	1	5	6	3	3	3	0	2	3
Salmonella Typhi	0	1	1	3	4	3	3	4	1	3	9	3
Hafnia alvei	4	1	1	5	4	3	0	1	3	6	2	2
Mycobacterium avium	2	3	0	1	0	2	2	2	1	2	2	2
Mycobacterium, other or unidentified	1	1	1	4	0	1	2	3	1	0	0	2
Proteus vulgaris	1	3	0	3	4	3	7	3	2	3	2	2
Yersinia enterocolitica	0	1	0	0	0	1	0	0	0	1	1	0
Yersinia pseudotuberculosis	1	2	2	1	1	0	0	0	1	0	0	0
Other bacteria	63	58	92	84	89	93	97	84	103	99	90	93
Bacteria, total	2835	3082	3055	3127	3328	3481	3562	3674	3966	3944	4092	4046
Candida albicans	41	44	29	43	45	42	54	55	55	55	57	74
Other candida species	15	27	23	35	24	22	22	25	42	28	37	30
Other fungi	0	0	2	1	2	1	2	2	4	5	2	5
Fungi, total	56	71	54	79	71	65	78	82	101	88	96	109

Table 17. Blood culture findings in patients aged 65 or over, 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Escherichia coli	1033	1179	1213	1314	1466	1624	1706	1760	1890	2056	2233	2481
Staphylococcus aureus	415	406	452	467	486	484	602	570	676	692	731	783
Klebsiella species	201	241	230	253	341	339	326	338	420	462	468	473
Staphylococcus epidermidis	228	253	228	231	254	284	265	275	299	270	325	315
Streptococcus pneumoniae	189	216	200	241	239	229	270	294	326	294	303	296
Enterococcus faecalis	144	142	149	146	192	183	202	220	217	222	229	274
Streptococcus, other beta-haemolytic	88	105	100	123	135	140	174	171	177	222	258	266
Bacteroides fragilis group	96	104	96	118	120	135	119	135	146	164	178	203
Enterococcus faecium	61	61	48	76	97	74	108	132	126	175	180	198
Pseudomonas aeruginosa	119	132	148	148	139	151	154	188	191	184	218	196
Enterobacter species	79	97	87	97	92	115	95	105	131	128	156	157
Staphylococcus, other coagulase-negative	120	108	134	112	114	116	129	139	165	155	143	156
Streptococcus viridans group	74	93	83	103	103	106	110	115	140	135	132	138
Streptococcus agalactiae	53	61	49	62	76	84	81	77	94	104	126	113
Proteus mirabilis	61	51	57	62	80	57	68	93	99	102	106	97
Citrobacter species	26	39	40	44	43	42	42	35	65	59	76	59
Streptococcus milleri group	42	30	28	43	45	50	67	54	53	62	59	58
Serratia species	15	30	15	28	18	33	27	33	50	37	59	56
Clostridium perfringens	23	31	26	27	32	29	36	39	34	49	40	51
Streptococcus pyogenes	21	28	46	28	33	34	48	58	50	61	50	51
Haemophilus influenzae	17	27	15	13	13	28	21	25	21	22	19	37
Enterococcus, other or unidentified	7	21	18	19	16	17	19	15	24	20	24	33
Listeria monocytogenes	7	15	11	19	18	20	26	26	26	20	44	31
Morganella morganii	12	9	13	10	14	21	14	26	11	18	29	30
Peptostreptococcus and Peptococcus	15	9	14	20	13	17	22	25	14	29	36	26
Clostridium, other or unidentified	28	25	23	18	25	21	22	31	18	27	35	24
Acinetobacter species	13	18	17	8	13	10	18	11	12	16	16	17

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Bacillus	13	17	11	10	10	10	17	9	11	12	7	14
Fusobacterium species	6	6	16	7	13	10	9	15	10	8	17	14
Prevotella species	5	8	11	4	11	10	10	8	11	15	13	14
Propionibacterium species	19	12	15	4	8	13	9	4	5	9	10	13
Streptococcus bovis group	9	10	7	9	20	12	17	17	15	25	12	12
Bacteroides, other than fragilis group	7	5	3	5	8	4	3	5	8	13	8	8
Proteus vulgaris	4	8	7	8	7	9	9	9	4	4	8	8
Pseudomonas, other than aeruginosa	9	3	6	6	3	7	9	11	10	11	10	8
Salmonella, other than Typhi	5	4	7	5	6	15	11	8	19	6	8	7
Capnocytophaga canimorsus	3	1	1	1	1	1	4	2	3	2	2	6
Neisseria meningitidis	5	4	4	4	3	2	5	2	6	6	6	6
Veillonella species	3	0	0	1	1	7	2	6	9	5	4	6
Stenotrophomonas maltophilia	4	8	3	6	10	6	10	8	3	6	7	4
Campylobacter species	2	3	3	1	5	3	5	3	5	6	3	1
Hafnia alvei	3	7	1	1	4	4	3	6	8	7	7	1
Mycobacterium, other or unidentified	2	2	0	2	3	0	5	1	2	0	5	1
Haemophilus, other than influenzae	0	0	2	1	3	2	2	1	1	1	1	0
Mycobacterium avium	0	0	1	0	0	1	0	0	1	0	0	0
Salmonella Typhi	0	0	0	1	0	1	0	0	0	0	0	0
Yersinia enterocolitica	3	1	1	3	1	1	1	1	0	1	1	0
Yersinia pseudotuberculosis	0	2	1	1	2	2	1	1	0	3	1	0
Other bacteria	66	59	68	87	96	96	96	82	124	123	121	143
Bacteria, total	3355	3691	3708	3997	4432	4659	4999	5189	5730	6048	6524	6885
Candida albicans	41	48	39	63	51	39	54	56	66	49	93	65
Other candida species	27	22	31	46	27	25	22	27	25	42	33	44
Other fungi	0	1	0	3	0	3	0	0	2	0	0	4
Fungi, total	68	71	70	112	78	67	76	83	93	91	126	113

Table 18. Group A Streptococcus blood findings by emm-type, 2006–2011 (no. of cases and %).

Cases notified to NIDR	Stains examined	emm1	emm28	emm84	emm89	Other	NT
2006	163	25 (15 %)	33 (20 %)	24 (15 %)	11 (7 %)	59 (36 %)	11 (7 %)
2007	205	58 (28 %)	26 (13 %)	32 (16 %)	12 (6 %)	72 (35 %)	5 (2 %)
2008	225	52 (23 %)	47 (21 %)	9 (4 %)	10 (4 %)	102 (45 %)	5 (2 %)
2009	191	25 (13 %)	56 (29 %)	4 (2 %)	29 (15 %)	74 (39 %)	3 (2 %)
2010	167	22 (13 %)	37 (22 %)	4 (2 %)	26 (16 %)	77 (46 %)	1 (<1 %)
2011	163	25 (15%)	37 (23%)	4 (2%)	30 (18%)	66 (40%)	1 (<1 %)

Table 19. Cerebrospinal fluid culture findings in patients aged 15 to 64, 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Staphylococcus aureus	11	0	6	10	17	10	9	16	13	13	12	20
Streptococcus pneumoniae	1	4	19	26	21	16	17	14	26	19	15	12
Staphylococcus epidermidis	1	1	27	21	24	34	32	17	27	18	11	10
Neisseria meningitidis	13	12	19	15	11	15	20	16	4	9	6	7
Staphylococcus, other coagulase-negative	0	0	12	6	16	14	12	7	14	10	8	6
Propionibacterium species	0	0	6	6	11	5	5	5	4	4	7	4
Streptococcus viridans group	0	0	6	2	1	4	7	2	1	2	2	4
Enterococcus faecalis	3	3	2	3	5	3	4	5	4	3	4	3
Acinetobacter species	0	0	2	1	1	3	3	5	2	3	0	2
Enterobacter species	0	0	1	0	3	5	2	2	9	3	1	2
Enterococcus faecium	0	0	1	0	2	1	0	1	0	1	0	2
Haemophilus influenzae	1	4	2	0	1	0	0	0	3	1	0	2
Haemophilus, other than influenzae	0	0	0	0	0	0	0	1	0	0	0	2
Klebsiella species	0	0	0	0	0	0	0	0	4	2	1	2
Streptococcus, other beta-haemolytic	0	0	2	0	1	1	0	0	1	2	1	2
Enterococcus, other or unidentified	0	1	1	0	0	0	1	1	1	0	0	1
Escherichia coli	2	0	3	0	0	7	4	3	3	4	1	1
Listeria monocytogenes	0	1	0	2	1	0	2	1	1	2	1	1
Proteus mirabilis	0	0	0	0	0	0	0	0	0	0	0	1
Pseudomonas aeruginosa	0	0	5	4	2	4	6	3	4	5	3	1
Pseudomonas, other than aeruginosa	0	0	0	1	0	0	1	1	1	1	0	1
Salmonella, other than Typhi	0	1	0	1	0	0	0	0	2	0	0	1
Serratia species	0	0	0	2	1	1	0	3	0	0	0	1
Stenotrophomonas maltophilia	0	0	0	0	1	0	0	1	0	0	0	1
Streptococcus pyogenes	0	0	1	1	0	0	1	0	2	2	1	1
Bacillus	0	0	5	0	0	3	6	4	3	0	0	0

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Campylobacter species	0	0	0	0	0	1	0	0	0	0	0	0
Capnocytophaga canimorsus	0	0	0	0	0	0	0	0	0	1	0	0
Citrobacter species	0	0	0	1	1	2	0	1	0	0	1	0
Corynebacterium species	0	0	0	1	1	2	1	1	0	1	0	0
Morganella morganii	0	0	1	0	0	0	0	0	0	0	0	0
Mycobacterium, other than avium	2	0	2	1	0	0	0	1	2	0	0	0
Peptostreptococcus and Peptococcus	0	0	0	2	0	0	0	0	0	1	0	0
Prevotella species	0	0	1	0	0	0	0	0	0	0	0	0
Streptococcus agalactiae	0	0	1	0	2	0	1	5	2	0	2	0
Streptococcus bovis group	0	0	0	0	0	0	0	0	0	0	1	0
Streptococcus milleri group	0	0	0	0	0	0	0	0	1	0	0	0
Other bacteria	0	0	6	3	3	5	10	7	5	7	2	6
Bacteria, total	34	27	131	109	126	136	144	123	139	114	80	96
Candida albicans	0	0	1	1	2	1	0	1	0	0	0	0
Other candida species	0	0	1	0	3	1	3	4	1	0	1	0
Other fungi	0	0	0	0	0	0	0	1	0	0	0	0
Fungi, total	0	0	2	1	5	2	3	6	1	0	1	0

Table 20. Cerebrospinal fluid culture findings in patients aged 65 or over, 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Streptococcus pneumoniae	0	0	4	5	4	8	10	4	7	10	6	7
Staphylococcus aureus	2	0	2	7	7	5	3	2	3	6	5	5
Listeria monocytogenes	0	1	2	4	2	4	3	2	2	2	6	4
Staphylococcus epidermidis	0	1	7	5	6	10	9	12	10	6	2	4
Bacillus	0	0	3	0	0	0	0	0	1	0	0	2
Escherichia coli	1	1	1	2	2	1	1	0	1	1	1	2
Citrobacter species	0	0	0	0	0	0	0	0	0	0	0	1
Enterobacter species	0	0	2	0	1	0	0	1	0	0	1	1
Haemophilus influenzae	0	0	0	0	0	1	2	2	1	1	0	1
Mycobacterium, other than avium	2	1	1	4	1	3	0	0	1	1	0	1
Propionibacterium species	0	1	4	0	1	0	2	0	2	2	1	1
Staphylococcus, other coagulase-negative	0	0	5	4	5	5	3	2	3	3	3	1
Acinetobacter species	0	0	2	1	0	0	1	1	0	0	0	0
Bacteroides fragilis group	0	0	0	0	0	0	0	0	0	1	0	0
Corynebacterium species	0	0	0	1	0	0	0	0	0	0	1	0
Enterococcus faecalis	1	1	2	3	0	2	2	3	0	1	0	0
Enterococcus faecium	0	0	0	1	0	0	0	0	0	1	0	0
Enterococcus, other or unidentified	0	0	1	0	0	0	0	0	0	0	1	0
Klebsiella species	0	0	0	0	0	0	0	0	1	1	0	0
Mycobacterium avium	0	0	0	0	0	1	0	0	0	0	0	0
Neisseria meningitidis	0	1	0	1	1	2	1	0	1	0	2	0
Peptostreptococcus and Peptococcus	0	0	0	1	0	0	0	0	0	0	0	0
Proteus mirabilis	0	0	0	0	0	0	0	0	1	1	0	0
Proteus vulgaris	0	0	0	0	0	1	0	0	0	0	0	0
Pseudomonas aeruginosa	0	0	0	0	1	0	1	0	2	0	0	0
Pseudomonas, other than aeruginosa	0	0	0	0	1	0	0	0	0	0	0	0
Serratia species	0	0	0	0	1	0	0	0	0	0	0	0

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Stenotrophomonas maltophilia	0	0	0	0	1	0	0	0	0	0	0	0
Streptococcus agalactiae	4	2	0	1	0	0	0	0	0	1	1	0
Streptococcus bovis group	0	0	0	0	0	0	0	0	0	1	0	0
Streptococcus milleri group	0	0	0	0	0	0	0	0	0	1	0	0
Streptococcus pyogenes	0	0	2	0	0	0	0	0	0	0	0	0
Streptococcus viridans group	0	0	1	0	1	0	1	1	0	3	1	0
Streptococcus, other beta-haemolytic	0	0	0	2	0	1	0	0	0	1	0	0
Other bacteria	0	0	3	2	1	2	3	2	1	1	5	3
Bacteria, total	10	9	42	44	36	46	42	32	37	45	36	33
Other candida species	0	0	2	0	1	0	2	0	0	2	0	2
Candida albicans	0	0	0	0	0	1	0	0	1	0	0	0
Fungi, total	0	0	2	0	1	1	2	0	1	2	0	2

Table 21. Blood culture findings in all age groups, 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Escherichia coli	1629	1836	1846	2011	2225	2455	2563	2651	2813	2991	3223	3473
Staphylococcus aureus	886	912	996	983	1064	1016	1241	1187	1268	1290	1383	1491
Streptococcus pneumoniae	599	654	642	766	741	733	744	783	919	852	833	774
Klebsiella species	327	365	377	386	514	542	482	509	631	660	682	645
Staphylococcus epidermidis	604	655	649	608	683	709	686	665	687	678	697	643
Streptococcus, other beta-haemolytic	149	172	179	206	240	238	306	289	290	340	393	405
Enterococcus faecalis	215	245	263	243	283	302	309	339	311	343	341	386
Staphylococcus, other coagulase-negative	284	255	321	262	285	273	298	337	362	351	335	345
Bacteroides fragilis group	169	170	158	177	189	221	204	218	256	233	289	314
Streptococcus viridans group	217	244	209	255	277	283	274	265	309	313	336	308
Enterococcus faecium	106	125	107	130	147	144	183	217	220	273	280	307
Pseudomonas aeruginosa	204	213	226	240	204	245	219	262	268	265	318	293
Enterobacter species	162	195	147	169	162	170	186	185	210	216	260	256
Streptococcus agalactiae	155	178	173	169	186	256	212	213	240	250	290	230
Streptococcus pyogenes	115	99	150	119	140	110	162	207	220	193	171	169
Streptococcus milleri group	93	77	78	91	93	107	132	118	127	121	129	145
Proteus mirabilis	79	71	72	73	97	69	87	109	113	120	132	114
Serratia species	26	40	33	44	32	50	49	56	78	65	82	92
Citrobacter species	50	60	56	55	64	59	71	56	90	90	109	87
Haemophilus influenzae	35	46	25	34	26	45	32	54	44	46	40	64
Clostridium perfringens	29	39	33	37	38	46	48	53	44	66	57	59
Peptostreptococcus and Peptococcus	33	31	36	43	28	38	40	36	26	56	52	58
Bacillus	46	41	34	39	29	37	46	37	46	38	43	51
Fusobacterium species	27	33	34	28	46	43	31	51	46	36	55	46
Enterococcus, other or unidentified	12	30	32	31	29	28	27	21	34	35	38	45
Clostridium, other or unidentified	67	53	53	34	43	46	46	50	39	49	60	44
Salmonella, other than Typhi	27	42	21	28	42	45	64	72	69	33	56	43

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Acinetobacter species	37	32	42	23	31	31	32	36	28	39	34	40
Listeria monocytogenes	17	24	20	32	25	30	38	36	34	30	61	38
Morganella morganii	20	13	16	14	18	24	22	33	25	26	35	38
Prevotella species	11	19	15	15	23	25	21	16	25	28	28	30
Neisseria meningitidis	35	35	34	30	28	28	32	29	22	24	30	26
Capnocytophaga canimorsus	6	7	7	7	7	9	12	10	11	13	13	23
Propionibacterium species	40	31	24	16	14	22	16	10	8	18	16	23
Veillonella species	7	4	2	4	2	13	7	11	12	12	10	19
Streptococcus bovis group	14	13	10	12	24	21	23	24	16	33	19	18
Bacteroides, other than fragilis group	10	11	8	5	13	6	7	8	13	23	9	15
Pseudomonas, other than aeruginosa	12	8	10	11	8	12	9	16	19	21	17	15
Stenotrophomonas maltophilia	17	25	18	14	25	19	18	18	22	22	23	13
Proteus vulgaris	6	11	7	11	11	12	16	12	6	7	10	10
Campylobacter species	14	18	10	11	18	8	8	11	12	17	13	5
Salmonella Typhi	0	1	2	5	5	6	3	6	1	3	9	5
Haemophilus, other than influenzae	1	8	6	3	8	9	6	4	5	1	3	4
Mycobacterium, other or unidentified	3	3	1	6	3	1	7	4	3	0	5	4
Hafnia alvei	7	8	2	6	8	7	3	7	11	13	9	3
Mycobacterium avium	2	3	1	1	0	3	2	2	2	2	2	2
Yersinia enterocolitica	3	2	1	3	1	2	1	1	0	2	2	0
Yersinia pseudotuberculosis	1	4	3	3	3	2	1	1	1	3	1	0
Other bacteria	142	129	188	191	211	215	212	191	244	237	239	256
Bacteria, total	6750	7290	7377	7684	8393	8815	9238	9526	10280	10577	11272	11474
Candida albicans	89	96	80	109	99	86	113	113	126	105	154	140
Other candida species	52	57	62	83	52	48	46	56	69	70	70	77
Other fungi	0	1	3	6	2	4	4	4	6	5	2	10
Fungi, total	141	154	145	198	153	138	163	173	201	180	226	227

Table 22. Cerebrospinal fluid culture findings in all age groups, 2000–2011 (no. of cases).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Staphylococcus aureus	15	0	9	22	28	16	12	21	21	24	20	27
Streptococcus pneumoniae	1	4	28	47	35	28	33	27	38	35	26	24
Staphylococcus epidermidis	1	3	44	30	37	49	44	32	43	28	16	18
Neisseria meningitidis	24	22	27	22	20	22	29	23	9	13	12	11
Staphylococcus, other coagulase-negative	0	0	24	13	25	22	15	9	21	15	11	7
Propionibacterium species	0	1	10	7	13	6	7	5	6	6	8	6
Listeria monocytogenes	0	2	2	6	3	4	5	3	3	4	7	5
Streptococcus viridans group	0	0	7	4	3	4	10	3	1	7	3	5
Escherichia coli	4	4	5	3	4	8	8	4	5	6	4	4
Haemophilus influenzae	3	6	2	3	1	2	2	2	4	3	0	4
Enterobacter species	0	0	3	0	6	5	2	3	9	4	2	3
Enterococcus faecalis	5	4	4	7	7	6	8	9	4	4	5	3
Acinetobacter species	0	0	6	2	2	4	5	6	2	3	0	2
Bacillus	0	0	8	0	0	3	7	4	4	0	0	2
Enterococcus faecium	0	0	2	1	3	1	1	1	0	2	0	2
Haemophilus, other than influenzae	0	0	0	0	0	0	0	1	0	0	0	2
Klebsiella species	0	0	0	0	0	0	0	0	5	4	1	2
Streptococcus agalactiae	8	5	6	2	12	7	8	11	5	7	11	2
Streptococcus, other beta-haemolytic	0	0	3	2	1	2	0	0	1	4	1	2
Citrobacter species	0	0	1	1	1	2	0	2	0	0	2	1
Enterococcus, other or unidentified	0	1	2	0	0	0	1	1	1	0	1	1
Mycobacterium, other than avium	4	1	3	6	1	3	0	1	3	1	1	1
Proteus mirabilis	0	0	0	0	0	0	0	0	1	1	0	1
Pseudomonas aeruginosa	0	0	5	4	3	4	7	3	6	5	3	1
Pseudomonas, other than aeruginosa	0	0	0	1	1	0	1	1	1	1	0	1
Salmonella, other than Typhi	0	1	0	1	0	0	0	0	2	0	0	1
Serratia species	0	0	0	2	3	1	0	3	0	0	0	1

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Stenotrophomonas maltophilia	0	0	0	1	2	0	0	1	0	0	0	1
Streptococcus pyogenes	0	0	4	1	0	0	1	0	2	3	1	1
Bacteroides fragilis group	0	0	0	0	0	0	1	0	0	1	0	0
Bacteroides, other than fragilis group	0	0	0	0	0	0	0	1	0	0	0	0
Campylobacter species	0	0	0	0	0	1	0	0	0	0	0	0
Capnocytophaga canimorsus	0	0	0	0	0	0	0	0	0	1	0	0
Corynebacterium species	0	0	0	2	1	2	1	1	2	1	2	0
Morganella morganii	0	0	1	0	0	0	0	0	0	0	0	0
Mycobacterium avium	0	0	0	0	0	1	0	0	0	0	0	0
Peptostreptococcus and Peptococcus	0	0	0	3	0	0	1	0	0	1	0	0
Prevotella species	0	0	1	0	0	0	0	0	0	0	0	0
Proteus vulgaris	0	0	0	0	0	1	0	0	0	0	0	0
Streptococcus bovis group	0	0	0	0	0	0	0	0	0	1	1	0
Streptococcus milleri group	0	0	0	0	0	0	0	0	1	1	0	0
Other bacteria	0	0	16	6	5	12	14	9	12	12	8	13
Bacteria, total	65	54	223	199	217	216	223	187	212	198	146	154
Other candida species	0	0	3	0	4	1	5	4	1	2	1	2
Candida albicans	0	0	1	1	3	2	0	1	1	1	0	0
Other fungi	0	0	0	0	0	0	0	1	0	0	0	0
Fungi, total	0	0	4	1	7	3	5	6	2	3	1	2

Authors

Respiratory infections

Influenza A and B
Niina Ikonen, Thedi Ziegler, Ilkka Julkunen, Outi Lyytikäinen (THL)

RSV
Thedi Ziegler, Outi Lyytikäinen (THL)

Legionella
Kirsi Valtonen, Jaana Kusnetsov, Outi Lyytikäinen, Sari Jaakola (THL)

Whooping cough
Kirsi Valtonen, Tuija Leino, Qiushui He (THL)

Adenovirus
Thedi Ziegler, Outi Lyytikäinen (THL)

Parainfluenza
Thedi Ziegler, Outi Lyytikäinen (THL)

Mycoplasma
Mirja Puolakkainen (University of Helsinki)

Chlamydial pneumonia
Mirja Puolakkainen (University of Helsinki)

Gastrointestinal infections

Salmonella
Ruska Rimhanen-Finne, Taru Lienemann, Anja Siitonen (THL)

Campylobacter
Markku Kuusi, Ulla-Maija Nakari (THL)

Yersinia
Elisa Huovinen, Anja Siitonen (THL)

Shigella
Markku Kuusi, Anja Siitonen (THL)

EHEC
Ruska Rimhanen-Finne, Aino Kyyhkynen, Anja Siitonen (THL)

Norovirus
Merja Roivainen, Markku Kuusi (THL), Leena Maunula (University of Helsinki)

Rotavirus
Tuija Leino, Merja Roivainen (THL)

Enterovirus
Katri Jalava, Merja Roivainen, Outi Lyytikäinen (THL)

Listeria
Ruska Rimhanen-Finne, Ulla-Maija Nakari (THL)

Clostridium difficile
Outi Lyytikäinen, Anni Virolainen-Julkunen, Silja Mentula (THL)

Significant intestinal infection epidemics
Ruska Rimhanen-Finne, Taru Lienemann, Ulla-Maija Nakari, Anja Siitonen (THL)

Hepatitides

Hepatitis A
Markku Kuusi, Irja Davidkin (THL)

Hepatitis B
Henrikki Brummer-Korvenkontio, Kirsi Liitsola (THL)

Hepatitis C
Henrikki Brummer-Korvenkontio, Kirsi Liitsola (THL)

Sexually transmitted diseases

Chlamydia
Eija Hiltunen-Back (HUS)

Gonorrhoea
Eija Hiltunen-Back (HUS), Antti Hakanen (THL)

Syfilis
Eija Hiltunen-Back (HUS)

HIV and AIDS
Henrikki Brummer-Korvenkontio, Kirsi Liitsola (THL)

Antimicrobial resistance

MRSA
Outi Lyytikäinen, Johanna Mäkinen, Jaana Vuopio (THL)

VRE
Outi Lyytikäinen, Minna Kardén-Lilja, Jaana Vuopio (THL)

ESBL
Outi Lyytikäinen, Jari Jalava (THL), Juha Kirveskari (Huslab)

Invasive pneumococcal disease
Outi Lyytikäinen, Jari Jalava, Lotta Siira, Anni Virolainen-Julkunen (THL)

Tuberculosis

Tuberculosis
Petri Ruutu, Merja Marjamäki (THL), Tuula Vasankari (Filha)

Other infections

Haemophilus
Maija Toropainen (THL)

Meningococcus
Kirsi Valtonen, Maija Toropainen, Outi Lyytikäinen (THL)

MPR-diseases (measles, mumps, rubella)
Irja Davidkin (THL)

Puumala virus
Kirsi Valtonen (THL)

Tick-borne encephalitis (TBE)
Kirsi Valtonen, Pirjo Turtiainen (THL), Olli Vapalahti (HUS)

Tularemia
Heidi Rossow (THL)

Pogosta disease
Katri Jalava (THL)

Borrelia
Kirsi Valtonen (THL)

Rabies
Kirsi Valtonen, Ruska Rimhanen-Finne (THL)

Malaria
Heli Siikamäki (HUS)

Dengue
Eeva Pekkanen (THL)

Other travel-related infections
Eeva Pekkanen (THL)

Blood and CSF findings in children
Timi Martelius, Outi Lyytikäinen (THL)

Blood and CSF findings in adults
Timi Martelius, Outi Lyytikäinen (THL)

Group A streptococcus
Kati Vuorenoja, Jaana Vuopio (THL)