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Infectious Diseases in Finland 2013

REPORT

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INFECTIOUS DISEASES IN FINLAND 2013

NATIONAL INSTITUTE
FOR HEALTH AND WELFARE

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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 figures 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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Infectious Diseases in Finland 2013.

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Introduction

The entry into force, on 6 November 2013, of Decision no 1082/2013/EU of the European Parliament and of the Council on serious cross-border threats to health entailed a significant change in cooperation at EU-level on the surveillance and prevention of infectious diseases. The Decision automatically attained legal validity in Member States and increased the Commission's powers to act not only in the prevention and surveillance of infectious diseases, but also with regard to environmental and chemical threats. The decision defines/specifies i.a. the EU system for the surveillance of infectious diseases, as well as the related national competent authorities (National Institute for Health and Welfare (THL) in Finland); the Early Warning and Response System ('EWRS') and its national representatives (the Ministry of Social Affairs and Health, and the National Institute for Health and Welfare (THL)) and the Health Security Committee, responsible for coordinating the prevention of cross-border threats to health, composed of representatives of Member States' competent authorities (Ministry of Social Affairs and Health).

The Decision clearly expands the powers of the Commission in terms of cross-border threats and obliges Member States to exchange information and coordinate preventive measures more efficiently than before.

It also provided the Commission with the authority to require reports from Member States on their preparedness and contingency plans and facilitates the conclusion of joint procurement contracts for EU-wide medical countermeasures, e.g. vaccines and medicines.

No significant changes occurred in national cooperation in the surveillance and prevention of infectious diseases in 2013 – unless the budget cuts, based on a Government decision, targeted at research activities in the administrative sector of the Ministry of Social Affairs and Health are regarded as such. These cuts will affect the National Institute for Health and Welfare as a whole and result in annual cutbacks in activities until at least 2017. As a result, the Department of Infectious Disease Surveillance and Control was also forced to implement staff reductions totalling five person-years, and to considerably reduce some of its microbe typing activities (*Yersinia* and *Clostridium difficile*). When developing the system for the surveillance of infectious diseases, preparations must be made for cuts known to be forthcoming in years to come.

In 2013, the national social welfare and health care reform remained incomplete, resulting in a significant delay in the overhaul of the Communicable Diseases Act. When this report was written, the principles underlying the social welfare and health care reform were clear and had been agreed. It is therefore possible that preparation of the Act will be completed by 2014 and will enter into force in 2015. This may involve changes, particularly in the division of duties and coordination of the regional and local prevention of infectious diseases, but may also facilitate closer cooperation between regional and national activities. The objectives of the drafting of the Act include enhancing the surveillance of healthcare-associated infections and improving the preconditions for their prevention.

EPIDEMIOLOGICAL OVERVIEW 2013

The influenza epidemic season in 2012–2013 turned out to be longer than in the previous season, with overlapping epidemics of both influenza A and B in January to February. Influenza A(H1N1)pdm09 emerged as the season's dominant virus, but the A(H3N2) viruses dominant in the previous season were also present throughout the country. Conforming with its typical pattern of seasonal variation, the RSV epidemic was smaller in scale than in the previous year. Virological surveillance of respiratory virus infections at sentinel sites included rhinovirus infections, which were diagnosed at a steady rate in both the autumn and spring season, whereas the mycoplasma epidemic that peaked in 2012 seems to have fallen back to its between-epidemic levels. The number of whooping cough cases was lower year-on-year. Fewer cases of tuberculosis were reported than in earlier years, but those who contracted the disease were younger than before. The fact that one third of cases were identified in foreign-born individuals is indicative of the gradual demographic change in epidemiology, as the number of cases of reactivation in the aged falls steadily. Pulmonary tuberculosis treatment outcomes rivalled those of most Member States, although they do not yet meet the WHO's targets in full.

Several severe food-borne epidemics were detected during the year, including a *Salmonella* Typhimurium epidemic resulting from sales of non-pasteurised milk, and two fairly extensive clusters caused

by EHEC. Background analyses strongly indicated food-borne infection, but the actual source of infection remained unidentified. An inter-Nordic hepatitis A epidemic was identified and was the probable cause of at least 11 cases in Finland. A strain with an identical genome was detected in the other Nordic countries, except Iceland. Frozen berries were the most probable source of infection. The number of hepatitis A cases was therefore five times higher than in the previous year.

The cause of an epidemic which affected almost 200 people in an Espoo hotel was initially difficult to identify and was not revealed until an expert laboratory identified it as a norovirus. The numbers of campylobacter and *Clostridium difficile* cases were somewhat lower than in the previous year. However, campylobacter remains the most common bacterial cause of gastroenteritis in Finland, but the reasons for its seasonal variation are not fully understood. Notable regional differences remain in the incidence of *Clostridium difficile.*

The fairly stable epidemiologal status of sexually transmitted diseases and HIV infection continued but, as in other Nordic countries, chlamydia infections continue to be notably common in Finland. With regard to gonorrhoea, so-called sex tourism seems to be a significant background factor in infections contracted abroad. Of hepatitis viruses, a higher number of cases of type C are still being reported at annual level. In the near future, the possibility of medical eradication will provide new options for the prevention of infections. However, in order to influence incidence in any major way, treatment should cover a significant part of the high-risk group. This would require the creation of efficient treatment models adapted for intravenous drug users.

Although a major percentage of the bacterial strains producing carbapenemase were of foreign origin, the first actual local epidemic caused by *K. pneumoniae* that had the KPC carbapenemase gene, was analysed in Finland. The number of MRSA cases and MRSA blood culture findings remained on a par with previous years, while the number of VRE cases decreased and the number of ESBL *E. coli* findings continued to grow. Only six cases of severe pneumococcal diseases caused by vaccine serotypes were detected in under 2-year-olds and all but one in unvaccinated children. The percentage of penicillin-resistant pneumococcal strains and those with reduced susceptibility began to fall.

The situation remained excellent with regard to measles, mumps and rubella (MMR diseases), thanks to high vaccination coverage. Only a handful of cases were detected, almost all of them being connected with unvaccinated persons travelling abroad.

The number of meningococcus infections decreased by one third in comparison with the three previous years. In Finland, conscripts in military service receive a quadrivalent polysaccharide vaccine, but otherwise meningococcus vaccines are mainly used in connection with travel and epidemics. The majority of cases caused by serogroup B involved young children; with regard to group Y, older age groups are the dominant category.

The number of tick-borne disease cases, both tick-borne encephalitis (TBE) and borrelia, remained on a par with previous years.

Via tourism, infectious diseases were carried to Finland – including diseases that only occur abroad, such as malaria and dengue fever, as well as a considerable number that have been eradicated or become rare in this country either through vaccinations or other preventive measures, such as salmonella, legionella, various sexually transmitted diseases and hepatitis A viral infections. Fifty people were exposed to rabies abroad.

Helsinki, 16 May 2014

Mika Salminen
Head of Department

Respiratory infections

- The 2012–2013 epidemic season for influenza A proved longer than the previous season.
- The influenza B epidemic occurred concurrently with the influenza A epidemic, in December–May.
- As expected, the RSV epidemic was smaller than the winter epidemic a year before.
- The number of *Mycoplasma pneumoniae* cases fell back to the level common between epidemics.
- The number of whooping cough cases was distinctly lower than in 2012.

ADENOVIRUS

In 2013, 700 confirmed cases of adenovirus infection were recorded (2012: 677). The largest number of cases occurred in the under 5 age group, but numerous cases also came to light in the 5 to 9, 15 to 19 and 20 to 24 age groups. The incidence was highest in November (more than 80 cases per month) and lowest in July and August (approximately 40 per month).

There are 57 known types of adenovirus. Some of them cause respiratory infections, while others cause gastrointestinal, eye or other infections. Adenoviruses are common pathogens in infants and small children; they occur more rarely in adults. No actual adenovirus epidemic was recorded in 2013, but adenoviruses occurred steadily throughout the year.

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.

INFLUENZA

In winter 2013, the epidemic season began in January, peaked in February and continued until mid-April. Viruses of the influenza A(H1N1)pdm09 subtype emerged as the epidemic dominant virus in the 2012–2013 season. Influenza A(H3N2) and B viruses occurred simultaneously with the dominant virus.

Influenza A

In 2013, 6,061 findings of influenza A were reported to the National Infectious Diseases Register NIDR, almost the same number as in the previous year (2012: 5960). National surveillance of influenza virus infections at the virology unit of the National Institute for Health and Welfare led to the detection of 220 influenza A infections, more than 80% of which had been caused by the influenza A(H1N1)pdm09 virus. During the epidemic season, both influenza A viruses (H1N1pdm09 and H3N2) were in circulation concurrently. The first isolated cases of influenza A infections were reported in autumn 2012, and an increasing number in December. Data in the NIDR and from the national influenza surveillance of the National Institute for Health and Welfare indicate that the epidemic in the 2012–2013 season peaked in weeks 5 to 11. During April, the number of cases began to decline gradually, until only isolated influenza A infections were being reported in May. The 2012–2013 epidemic season lasted longer than the previous one. Influenza A infections were found in all age groups. Although the national influenza vaccination programme offers a seasonal influenza vaccination free of charge for children in risk groups and their inner circle, and healthy children aged 6 to 35 months, the highest number of influenza A cases (n=708) was reported in the 0 to 4 year age group. Reasons for the elevated morbidity in this age group may include poor vaccination coverage, which may have been influenced by the news coverage of the association between the 2009 pandemic vaccination

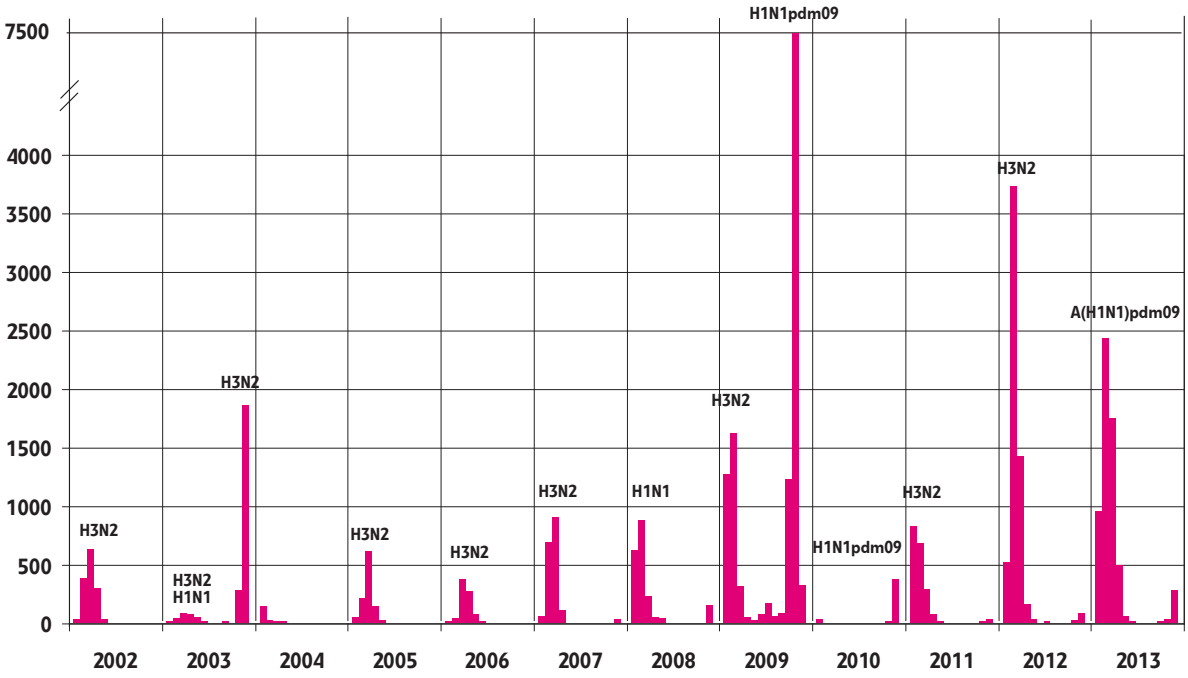


Figure 1. Cases of influenza A by month, and epidemic virus serotypes 2002–2013 (no. of cases).

(Pandemrix) and cases of narcolepsy, and false notions of the prevalence and severity of the influenza outbreak.

The genetic diversity of both the influenza A(H1N1) pdm09 and A(H3N2) viruses has increased in recent years. Several genetic groups were found in both influenza A subtypes in 2013.

Four years since they appeared, the diversity of A(H1N1)pdm09 viruses has increased and several genetic groups circulating as epidemics have been identified. The cases of influenza A(H1N1)pdm09 identified during the 2012–2013 epidemic season represented two genetic groups which are also frequently found elsewhere in Europe; no antigenic differences were detected between these groups or between them and the A/California/07/2009 vaccine virus.

The epidemic viruses of the influenza A(H3N2) group circulating worldwide comprised two distinct genetic groups, Perth/16/2009 and Victoria/208/2011, with some antigenic differences. Further genetic subgroups may be detected within these two groups. In 2012, the occurrence of viruses belonging to the Victoria/208/2011 lineage increased and a virus of the Victoria/208/2011 lineage was introduced in the season's influenza vaccine A(H3N2) for the season 2012–2013. Influenza A(H3N2) viruses found in Finland during the 2012–2013 epidemic season were all of the Victoria/207/2011 lineage, belonging to a genetic subgroup whose viruses circulated abundantly in other parts of Europe.

Influenza B

Following the weak influenza B epidemic of 2012, a total of 1,692 cases of influenza B were reported to the NIDR in 2013 (2012: 464). The influenza B epidemic of the winter of 2013 coincided (December–May) with the influenza A epidemic. Influenza B virus infections were diagnosed in all age groups.

Of the two influenza B virus lineages that have circled the world in recent years, the occurrence of the Yamagata lineage increased in 2012. In the epidemic season 2012–2013, viruses of both the Victoria and Yamagata lineage were found in Finland. However, the majority of Finnish influenza B viruses were of the Victoria lineage, which differed from the virus contained in the vaccine. Small numbers were reported of the two Yamagata lineage viruses that are circulating the world, which differ from one another genetically and are slightly divergent in terms of their antigenes.

Vaccine for the epidemic season 2013–2014

Based on reports of the influenza A and B epidemic viruses circling the world, the WHO recommended a change to the vaccination composition in the Northern Hemisphere for the epidemic season 2013–2014. The recommendation was that the influenza A(H3N2) virus component be changed to A/Texas/50/2012,

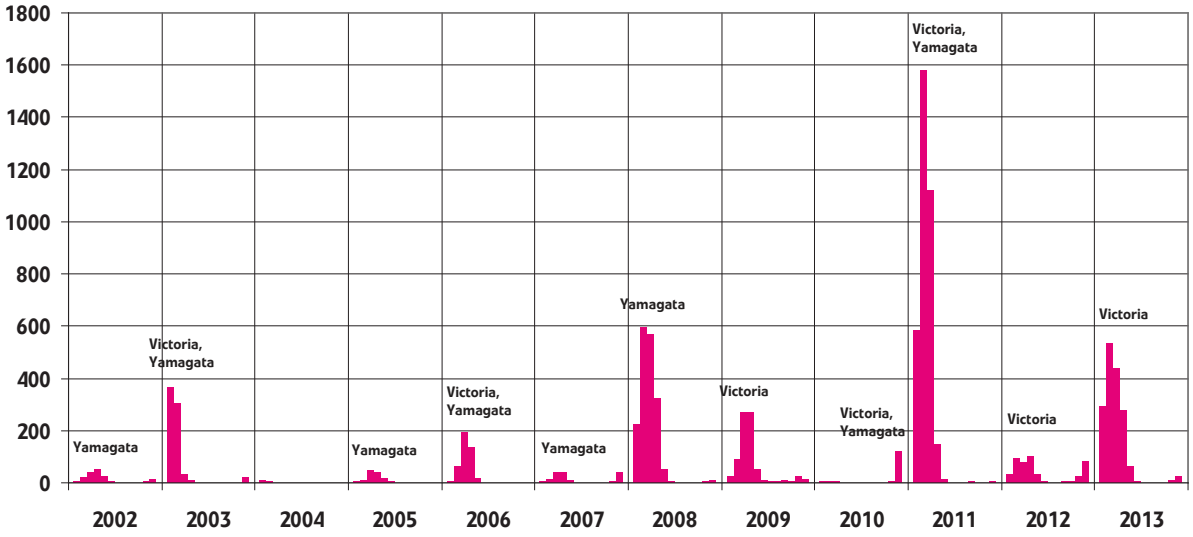


Figure 2. Cases of influenza B by month, and epidemic virus serotypes 2002–2013 (no. of cases).

which has a better antigenic correspondence to the viruses similar to A/Victoria/361/2011 that are circulating as epidemics. The influenza A(H1N1)pdm09 component remained unchanged, in the form of the A/California/07/2009 virus.

The influenza B virus component was changed to B/Massachusetts/2/2012, that continued to represent viruses of the Yamagata lineage, but differed antigenically from the influenza B virus component previously used in the vaccine.

Season 2013–2014

The first cases of influenza A and B infections were reported in November and December 2013. The season 2013–2014 began slowly, with the number of influenza cases increasing gradually in December–January and peaking around mid-February. Both influenza A viruses were reported during the season, although the influenza A(H1N1)pdm09 virus emerged as the dominant strain. Individual cases of infections caused by an influenza B virus of the Yamagata lineage were reported.

A more detailed analysis of the epidemic viruses circulating Finland in the 2012–2013 season has not yet been completed, but preliminary findings show that the epidemic influenza A viruses found were very similar to the influenza A(H3N2) and influenza A(H1N1)pdm09 and influenza B components contained in the seasonal vaccine. In February 2014, the WHO issued a new vaccine recommendation for the northern hemisphere 2014–2015 epidemic season, based on the then current epidemic situation, recommending that no changes be made to the composition of the vaccine.

Campaigning for the seasonal influenza vaccination continued to emphasise the fact that in the 2013–2014 season the close contacts of any person prone to severe influenza should be vaccinated as part of the national vaccination programme. The data on the coverage of the seasonal influenza vaccination in the 2013–2014 season will be completed by the end of April.

PARAINFLUENZA

Parainfluenza viruses are grouped under one heading in the NIDR, even though laboratories usually differentiate between parainfluenza viruses 1, 2 and 3. In 2013, 429 parainfluenza infections were confirmed (2012: 401), most of them in the 0 to 4 age group. The highest monthly number of cases (80–108) was recorded in April–May and December (71). 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. Type 1 and 2 viruses, on the other hand, do not cause epidemics every year. Parainfluenza viruses, especially type 1, typically cause laryngitis in small children.

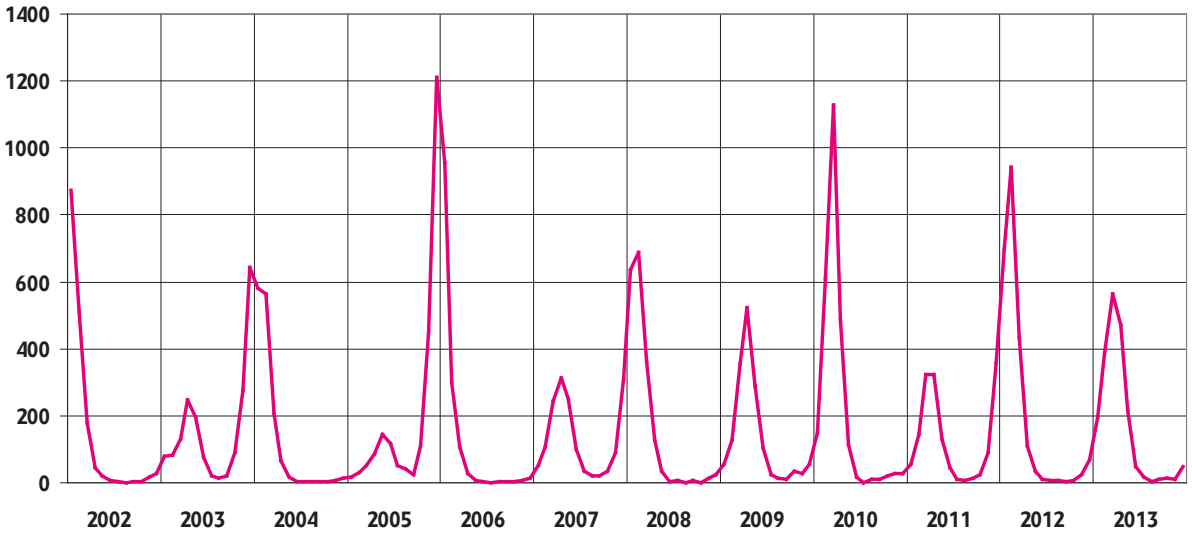


Figure 3. Cases of RSV per month, 2002–2013 (no. of cases).

RHINOVIRUS

In 2013, more than 420 confirmed cases of rhinovirus infection were recorded (2012: 211). The incidence was highest in May, October and November (ca. 50/month) and lowest in January (12/month). Almost 60% of these infections were diagnosed in children under the age of 4.

More than 150 types of rhinovirus are known. They are the most common cause of mild respiratory infections. Rhinoviruses are most common in young children, but are present in all age groups. In 2013, rhinovirus infections were reported in several garrisons. In spring 2013, the rhinovirus epidemic partly coincided with the peak of the parainfluenza season in May. Typically, the rhinovirus epidemic of the autumn began after the start of the school term in August and continued fairly steadily throughout the autumn season.

Since August, rhinoviruses have been included in the surveillance of respiratory virus infections conducted at the virology unit of the National Institute for Health and Welfare (THL), which may partly contribute to the increase in the number of cases. Laboratories use the PCR test to detect rhinoviruses in clinical samples. This test is extremely sensitive and reliable. Specialised virus laboratories are also able to culture rhinoviruses.

RSV

In 2013, 1,997 cases of RSV confirmed by laboratory tests were reported to the NIDR (2012: 2345). Through long-term surveillance, a major RSV epidemic has been observed in Finland every other winter, often starting in November–December, with a minor epidemic occurring between the major ones. As expected, the major winter epidemic of 2012 was followed by a minor epidemic that began in January 2013 and continued until May. The incidence of RSV varied by hospital district (4–79/100,000), most probably due to differences in the use of laboratory diagnostics. As in earlier years, the majority of RSV cases (almost 90%) were found in children aged 0 to 4. Although RSV infections are present in all age groups, cases requiring hospitalisation and laboratory diagnostics mainly involved infants and small children.

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 genetic replication methods for diagnosing RSV.

WHOOPING COUGH

In 2013, the number of whooping cough cases reported to the NIDR totalled 192 (3.6/100,000). This was clearly less than in 2012 (536; 9.9/100,000). The cases were concentrated in the 0 to 14 age group, four

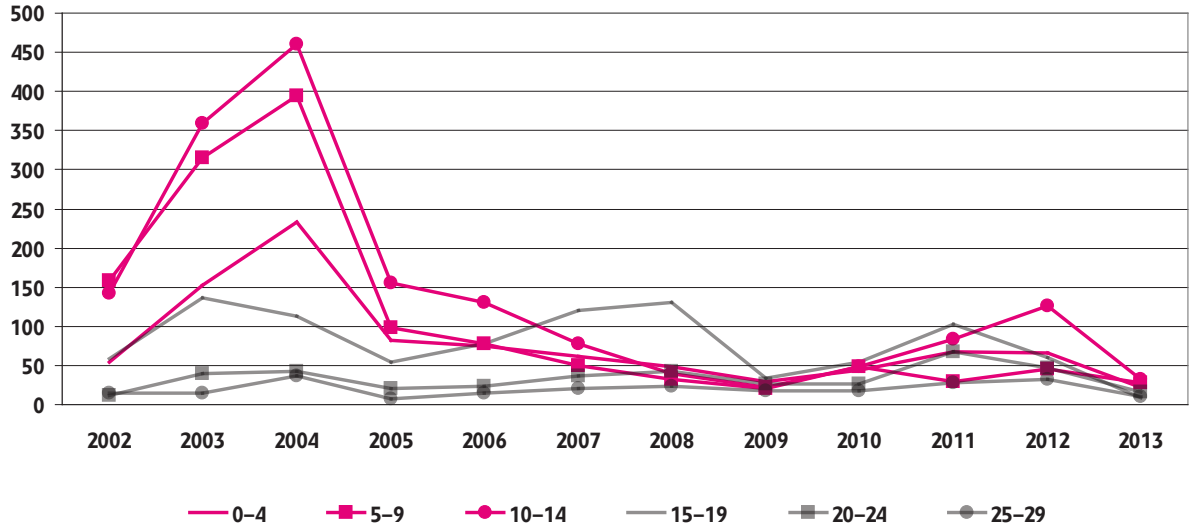


Figure 4. Cases of whooping cough in children's and young adults' age groups 2002–2013 (no. of cases).

of the patients being under the age of 12 months and three of them under the age of three months. The diagnosis of all patients under 12 months old was based on a PCR test, while the majority of cases were diagnosed from antibody testing (178).

In 2013, all of the strains found, except for one strain of *B. pertussis* (1/5), produced pertactin, one of the components of the vaccine used in Finland.

As in earlier years, the incidence of whooping cough varied considerably by hospital district (0–13.7/100,000), being highest in the Kanta-Häme Hospital District. No cases were reported in the Åland Islands, Itä-Savo, Lapland and Länsi-Pohja hospital districts.

Choosing an optimum vaccination strategy for whooping cough is difficult, as the available vaccines are incomplete in efficiency and duration. A booster for six-year-olds was added to the national vaccination programme in Finland in 2003. In 2005, the whole-cell vaccine was replaced with a cell-free combination vaccine containing the pertussis antigen for children in the age groups covered by child care clinics. Until 2007, adolescent vaccinations were given between the ages of 11 and 13. Since 2009, the recommendation has been to vaccinate adolescents at the age of 14 to 15, i.e. beginning in the 8th grade of comprehensive school. Due to this transition, very few of these vaccinations were administered between 2009 and 2011. This created a temporarily less well protected cohort in adolescent age groups. Illness in infancy indicates insufficient herd immunity. Nevertheless, Finland has so far been spared the extensive whooping cough epidemic that generated more than 40,000 cases in the USA and almost 10,000 cases in the UK during 2012. In 2012, the year the epidemic occurred, on the basis of an extensive strain collection in the United States it was discovered that 60% of *B.pertussis* strains did not produce pertactin.

CHLAMYDIA PNEUMONIAE

In 2013, 285 cases of *Chlamydia pneumoniae* were reported based on antibody testing. Relative to the population, the highest incidence was recorded in the hospital districts of Vaasa and Lapland (12/100,000). In the South Karelia, Kainuu, Kymenlaakso, Länsi-Pohja and Satakunta hospital districts, the incidence (9/100,000) was also above the national average (5/100,000). The number of reported infections was highest among 10 to 24-year-olds, but cases can be found in all age groups.

LEGIONELLA

In 2013, 32 cases of legionellosis were reported. Four of these were diagnosed on the basis of two laboratory tests; 11 findings were based on the detection of the antigen in the urine, four on the isolation of the bacterial strain, one on the detection of nucleic acid in sputum, and 20 on serological methods. Further investigation revealed that the clinical presentation was consistent with legionella pneumonia in 15 cases (47%). Of a total 15 such cases, 11 tested positive for the presence of the legionella antigen in the urine, the bacterial strain was isolated in three cases

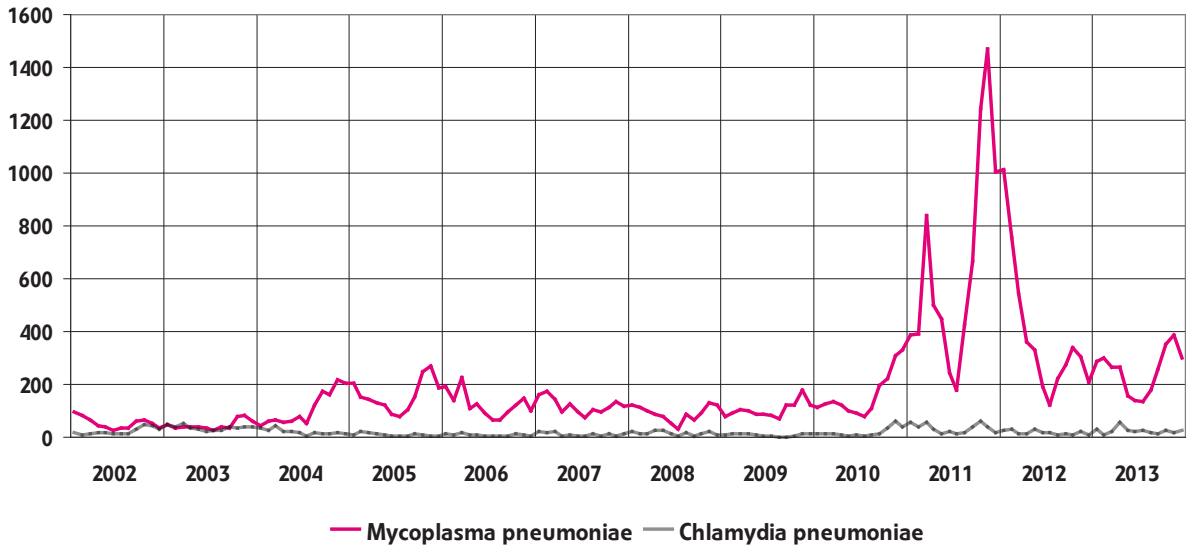


Figure 5. Cases of Mycoplasma pneumoniae and Chlamydia pneumoniae per month, 2002–2013 (no. of cases).

and serological proof was found in four cases. All except five of the patients had been abroad before falling ill, nine in European countries and one in the Far East. One infection of domestic origin was fatal. 80% of the patients with legionella pneumonia were male, with an average age of 56 (52–67) years. Of all cases found positive in the culture, three were pneumonias belonging to *L. pneumophila* serogroup 1 and one *L. longbeachae* wound on the palm was related to the handling of flowerbed soil.

Various premises (home, residential home, health centre) were investigated in more detail as possible sources of infection in the case of one patient who contracted the illness in Finland. Before cleaning measures were taken, legionella concentrations in the examined water systems were 500–30,000 cfu/l (colony forming units per litre) and, afterwards, only 100 cfu/l at most. The threshold for measures requiring cleaning is >1,000 cfu/l according to the European guideline for legionella, which is followed in Finland.

Internationally, the EIA antigene test of urine is the most commonly used method of diagnosis. Reports on EIA based methods indicate that microtitre plate based tests would be both more sensitive and specific than membrane based tests.

Accommodation data related to all of the patients who fell ill abroad was reported to ELDSNET (European Legionnaires' Diseases Surveillance Network), which collects data on travel-related cases of legionellosis. European surveillance indicates that the majority (ca. 60–70%) of cases are of community origin, some 20% are associated with travel and fewer than 10% originate in hospitals. In Finland, cases of legionellosis are most often linked with travel. Legionellosis is not often suspected in cases of pneumonia of domestic origin, contracted outside hospitals.

MYCOPLASMA PNEUMONIAE

In winter 2011–2012, Finland experienced the second peak of a dual-peak *Mycoplasma pneumoniae* epidemic. In 2013, the total number of *M. pneumoniae* cases was 3,026, having exceeded 4,600 in 2012 and more than 7,800 in 2011. Hence, we are once again in the lull between epidemics.

As in the previous year, the majority of cases (more than 1,000) were recorded in the Helsinki and Uusimaa Hospital District. More than 60% of these cases were detected in individuals aged 5–24. The incidence was highest in the Hospital District of Itä-Savo (190/100,000).

As the lull between epidemics is likely to last 4 to 7 years, now is the time to improve the related diagnostics. No study has been performed before now of the macrolide resistance of *M. pneumoniae,* which has increased in other parts of the world in recent years. However, preliminary findings indicate that resistant strains based on mutations described elsewhere are also present in this country.

Gastrointestinal infections

- Frozen strawberries were suspected as the source of a Nordic epidemic of hepatitis A. In order to prevent infections, a recommendation was issued that frozen berries of foreign origin be heated before use.
- Almost 200 people contracted gastroenteritis in May–June after visiting a hotel in Espoo. Exceptionally, ordinary diagnostic methods were unable to detect a norovirus in patient samples.
- The number of *Clostridium difficile* cases has continued to decline. Notable regional differences in incidence rates continue.
- EHEC was the cause of two fairly extensive clusters. In one of these, the suspected probable source of infection was widely circulated food and, in the other, the connecting factor was day care food.
- Slightly fewer findings of campylobacter were reported to the National Infectious Diseases Register than in the previous year, but campylobacter still remains the most common bacterial cause of gastrointestinal infections in Finland.
- The number of listeria cases reported was equal to that of the previous year. More than one half of patients were aged over 75 in this case.

FOOD-BORNE EPIDEMICS

Since the beginning of 2010, municipal epidemic investigation working groups have 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. This system is known as the RYMY information system. In 2013, the National Institute for Health and Welfare conducted a user survey, which indicated that the system's strengths included ease of entering notifications of suspected cases, rapid communication of information between various actors, and the users' commitment to and positive attitude towards the electronic reporting system. Listed system weaknesses included poor usability, a lack of reporting features and the slow implementation of proposed modifications and suggested improvements to the system. The future challenge is to construct a system that would contribute to higher efficiency in analysing and preventing epidemics, and enhancement of the quality of investigations.

The National Institute for Health and Welfare supports municipal epidemic investigation working groups focusing on food- and water-borne epidemics and, whenever necessary, coordinates the investigation of epidemics e.g. if the epidemic in question is exceptionally severe or geographically widespread. In 2013, 73 notifications of suspected cases were entered in the RYMY information system (in 2012: 88) and the National Institute for Health and Welfare contacted the municipal epidemic investigation working group with regard to 26 notifications. Several other gastrointestinal infection clusters were investigated as well.

The National Institute for Health and Welfare is also involved in the Epidemic Intelligence Information System EPIS, coordinated by the European Centre for Disease Prevention and Control (ECDC), which, in case epidemics arise, enables European countries to provide and gain information on epidemic investigations in other countries. In 2013, the National Institute for Health and Welfare participated in the prevention of 37 international bacterial gastrointestinal epidemics by providing up-to-date information on the situation in Finland via EPIS. Four EPIS queries were sent from Finland regarding two domestic epidemics of EHEC O157, one of which was *S.* Typhimurium FT 120, the other being *S.* Typhimurium FT U311. Moreover, in the Molecular Surveillance Pilot project, coordinated by ECDC, the National

Institute for Health and Welfare participated in the investigation of seven (*S.* Enteritidis FT 8, *S.* Virchow, *S.* Kentacky and four *Listeria monocytogenes*) international epidemic clusters.

EHEC caused two fairly extensive clusters

In April-May, ten people were infected with a sorbitol-fermenting EHEC O157:H7 (FT 88, stx2, hlyA, eae) strain. The same EHEC strain was found in three patients in December, in addition to which a family member of one patient was diagnosed with haemolytic-uremic syndrome (HUS) without an EHEC finding in the faeces. The patients were children aged 1 to 8. Interviews did not reveal any particular event or farm visit, consumption of non-pasteurised milk or a meal in a certain restaurant or restaurant chain that would have constituted a connecting factor between the patients. Because the patients came from different parts of Finland, it is probable that the source of infection was widely circulated food or another product contaminated by the EHEC bacteria. According to the expert network of the European Centre for Disease Prevention and Control, no similar bacterial strain had been found in other European countries or the United States.

In Lohja, an epidemic caused by the EHEC O157:H7 (FT2, stx2, hlyA, eae) strain was diagnosed in October–November. The connecting factor between the patients was identified as day care food, but the source of infection remained unidentified. At the end of October, eight children were infected by the strain in question, and in November the infection was diagnosed in nine of these children's family members. In connection with the epidemic, some 300 stool samples from asymptomatic day care children, day care personnel, close contacts of patients and people who had contacted basic health care due to symptoms were analysed for EHEC bacteria.

Frozen strawberries the suspected source of a Nordic epidemic of hepatitis A

In January–October, 11 cases of hepatitis A were diagnosed in different parts of Finland and the virus type 1B was detected in the related serum samples. The affected persons had not travelled abroad prior to the occurrence of their symptoms. A virus of the same genotype was also identified in Denmark, Norway and Sweden. Moreover, five 5 IgM positive cases of hepatitis A were detected, but their samples could not be genotyped. On the basis of a pan-Nordic case-control study, frozen strawberries were the most likely source of infection. However, the hepatitis A virus was not found in the strawberries and their origin has yet to be verified. In order to prevent infections, a recommendation was issued that frozen berries of foreign origin be heated.

Recurrent epidemics caused by a new type of norovirus in Espoo

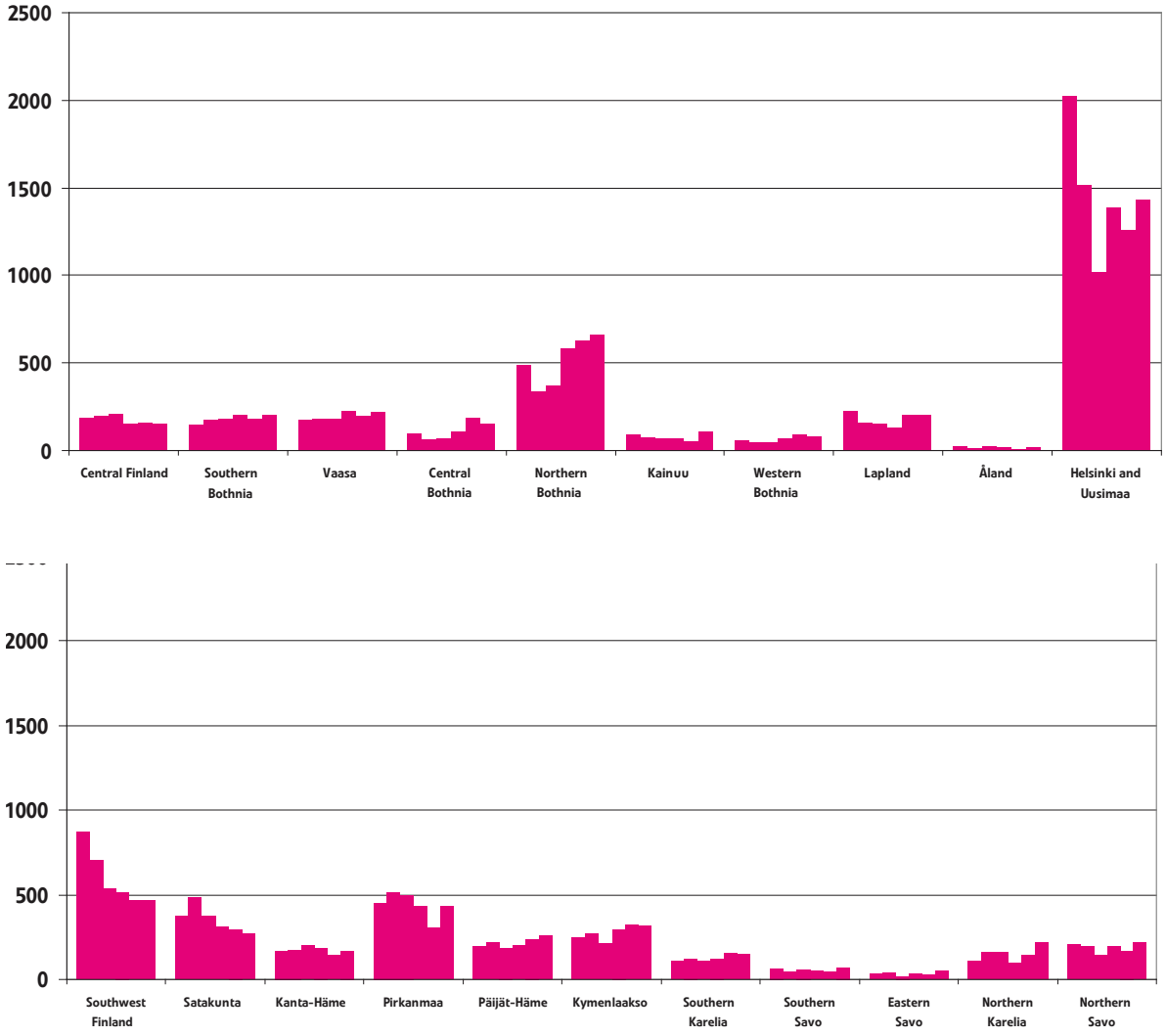
In May–June, more than 170 people among ten groups of customers contracted gastroenteritis after visiting a hotel in Espoo. The patients' symptoms, the incubation period of the disease and its duration were indicative of a norovirus epidemic but, using standard diagnostic methods, no norovirus could be found in the patient samples. Further analyses by the National Institute for Health and Welfare revealed that the samples contained a norovirus belonging to genogroup 1. Thereafter, the same type of virus was found in a repeat analysis of a water sample taken in May, and surface cleanliness samples taken in June in the hotel dining room toilet facilities. The epidemic was controlled by cleaning and disinfecting the household water supply system and enhanced cleaning of the hotel premises.

Salmonella clusters

In June, *S.* Enteritidis FT 3, susceptible to antimicrobials, caused six cases in Eastern Finland, connected to travel in Russia and identical in genotype (MLVA 3-2-7-10-2, SENT 15). The health authorities of the Republic of Karelia were informed of the cases.

In October, salmonella was detected in cattle suffering from diarrhoea on a farm in Western Finland. The people living on the farm, and the families to whom non-pasteurised milk had been sold by the farm, were examined in case of salmonella infection. *S.* Typhimurium FT135, susceptible to antimicrobials, was detected in eight persons, one of whom showed symptoms, and in the cattle faeces. An MLVA 2-14-11-11-0312, STYM 245 strain, identical to the strains detected in the people who were tested, was identified in the farm environment and the cat living on the farm.

In October-November, (ACSSuT) *S.* Typhimurium FT 120, resistant to antimicrobials, caused a cluster of infections, with ten cases being diagnosed in different parts of Finland. The strains in this cluster comprised two highly similar genotypes (MLVA 3-15-14-23-0311 and 3-15-14-23-0110). A strain similar in susceptibility and phage type was detected in a strain isolated from German pork but an MLVA analysis indicated that it was different from the strains identified in the patients.



Figures 6a and 6b. Cases of Clostridium difficile by hospital district, 2008–2013 (no. of cases).

In October–December, eight cases caused by monophasic *S.* Typhimurium FT U311 strains were detected in nursing home units situated in different localities. Identical strains (MLVA 3-13-11-NA-0211, resistance profile ASSuT) were also detected in Norway and Sweden. Analyses are still underway.

CLOSTRIDIUM DIFFICILE

Clostridium difficile has been a finding reportable to the NIDR from the beginning of 2008. In 2013, almost 6,000 cases were reported (2012: >6,000, 2011: >6,000, 2010: >6,000, 2009: >7,000, 2008: >8,000), of which 4,855 (2012: 5,256, 2011: 5,382, 2010: 4,804, 2009: 5,700, 2008: 6,301) involved a toxin-producing strain. Almost 60% of the patients diagnosed with *C. difficile* were women, and about half were 75 years of age or older. A total of 183 (4%) cases of toxin-positive strains were reported in those under the age of 15 (2008–2012: 2–3%). There were notable regional differences in incidence (32–206/100,000), which was highest in the Central Ostrobothnia, Lapland, Kymenlaakso and North Ostrobothnia Hospital Districts.

The *C. difficile* bacterial strains typed at the National Institute for Health and Welfare originated in nine different hospital districts and covered 4% of the number of cases of infectious diseases reported. The strains were heterogeneous, and 58 different ribotypes were found. The submitting laboratory found that a considerable share (22%) of the typed strains had a potentially hypervirulent toxine gene profile (toxine A/B+, binary toxine+, tcdC deletion); these strains represented 23 different ribotypes, of which 078,

023, 027 and 126 were the most common. For the first time, ribotype 078 was the most common (11% of strains), while the share of ribotype 027 was 9.7% (2012: 4.3%). Other common ribotypes included 023, 002, 020, 014, 001 and 005. Typing focused on severe cases and suspected epidemics. Background data indicates that 2.6% of the strains were related to severe cases, 15% to recurring infections and 16% to suspected epidemics.

ENTEROHAEMORRHAGIC ESCHERICHIA COLI (EHEC)

A total of 98 microbiologically confirmed cases caused by enterohaemorrhagic *Escherichia coli* (EHEC) were reported to the NIDR (1.8/100,000). The number of infections tripled from 2012, when 30 infections were detected (0.6/ 100 000). In previous occasions in the 2000s, the annual incidence of EHEC cases has been low in Finland (0.2–0.6/ 100,000) but in 2013, more than half of infections (61; 59%) were deemed to be of domestic origin. The incidence was highest in under 5-year-olds (10.5/100,000). Haemolytic-uremic syndrome was diagnosed in 13 cases (13%).

A total of 17 of the cases were connected to the EHEC O157:H7 (stx2, eae, hlyA) epidemic diagnosed in day care centres and schools in Lohja. A central kitchen was the connecting factor between the day care centres and schools in which the cases were diagnosed. Moreover, in the spring and towards the end of the year, a total of 16 cases caused by a sorbitol fermenting EHEC O157:H7 (stx2, eae,hlyA) strain were diagnosed in different parts of Finland. According to interviews, seven patients had been in contact with a farm, and an EHEC strain identical with the patient strains was found on two farms. In addition, a family epidemic, probably connected to a farm, was detected in December, with an EHEC O157:H7 (stx1, stx2, eae, hlyA, PFGE 1.164) infection being diagnosed in five family members. The same EHEC strain was detected on a farm where a family member, in whom EHEC was not found and who did not exhibit any symptoms, had worked at the end of November.

A bacterial culture for a total of 98 EHEC cases was confirmed by a laboratory. Of these, seven (7%) could only be confirmed using the PCR method, while the bacterial strain was isolated for others. Of the infections, 65 were acquired in Finland and 33 abroad. Strains of serotype O157:H7 caused a total of 58 cases. They were divided into eight phage types, the most common being FT 8 (33%), FT 2 (29%) and FT 88 (28%). All FT 88 strains were connected to two domestic clusters that occurred on separate occasions, in the spring and towards the end of the year; were positive with regard to the *stx*2 gene; were sorbitol-fermenting; were immobile despite the gene coding for a H7 flagella antigen; and, with the exception of one strain, were identical in PFGE genotype (1.203). All FT 2 strains were connected to the epidemic in Lohja, were positive with regard to the *stx*2 gene, were not sorbitol-fermenting, and, with the exception of one strain, were identical in PFGE genotype (1.211). There were 33 cases of serogroup Non-O157. The strains isolated from them comprised 12 different non-O157 serotypes. Serotype O26 was the most common (11 strains), comprising 5 different PFGE genotypes in turn. Two strains remained untyped (ONT) and one lacked the O antigen (O rough).

CAMPYLOBACTER

In 2013, 4,064 findings of campylobacter were reported, slightly fewer than in previous years, but campylobacter remains the most common bacterial cause of gastrointestinal infections in Finland. *Campylobacter jejuni* remained the single most common type of campylobacter (2,448 cases); there were 180 reported cases of *C. coli*, and 1,436 cases in whose case the campylobacter type was not specified.

The incidence in the entire population was 75/100,000. Men accounted for 52% of the cases. The highest number of cases was reported in the age group 20 to 54 (incidence over 100/100,000). Incidence was highest in the hospital district of Helsinki and Uusimaa (112/100,000).

The seasonal variation was typical of campylobacter: the incidence was highest in July–August (Figure 7). Of the cases in 2013, 478 (12 %) were domestic in origin, although 38 % of the cases lacked data on the country of acquisition. Foreign travel was a factor in 50% (2,032) of the cases; the most common source being Spain (302), followed by Thailand (287) and Turkey (285).

LISTERIA

In 2013, a total of 61 severe systemic infections caused by *Listeria monocytogenes* bacterium were diagnosed (2000–2011: 18–71, 2012: 62). About half of the patients were over the age of 75; men and women were equally represented. The listeria cases were spread out across the country. As yet, information on pregnancy is not reported to the National Infectious Diseases Register, but one case of listeriosis was diagnosed in a newborn baby on the basis of laboratory referrals. Upon the introduction of electronic notification of

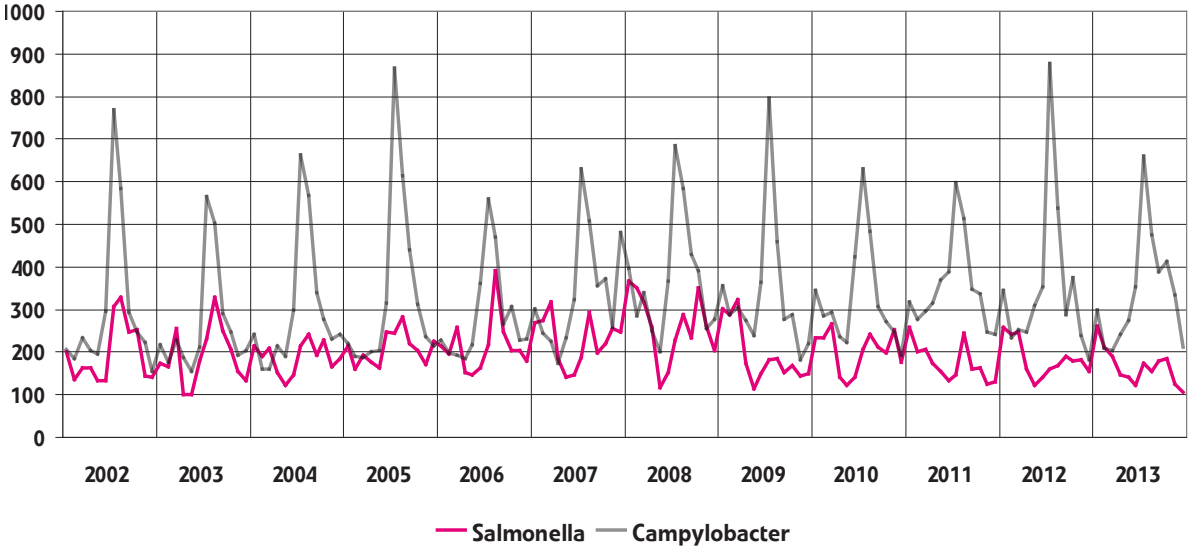


Figure 7. Salmonella and campylobacter cases by month, 2002–2013 (no. of cases).

Table 1. The most common serotypes of salmonella cases, 2002–2013 (excluding S. Typhi and S. Paratyphi) (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Infection acquired abroad (Source: NIDR)												
Salmonella Enteritidis	904	887	758	834	879	735	1066	657	778	612	480	521
Salmonella group B	33	23	37	38	55	93	166	119	103	144	143	170
Salmonella Stanley	65	67	105	113	116	175	136	111	98	68	98	69
Salmonella Typhimurium	115	155	183	194	141	246	198	166	142	80	92	79
Salmonella Infantis	20	16	33	39	31	54	31	42	42	31	46	37
Salmonella Corvallis	10	40	39	60	56	59	70	68	42	45	42	35
Salmonella Virchow	55	67	74	88	80	135	115	90	77	35	30	29
Salmonella Newport	47	40	53	47	66	57	76	54	54	32	30	27
Salmonella Oranienburg	5	7	11	5	10	9	13	2	14	41	27	24
Salmonella Agona	29	21	26	23	25	20	33	22	25	23	30	23
Other	561	539	521	504	524	690	702	608	655	503	658	973
Total	1844	1862	1840	1945	2027	2273	2606	1939	2030	1614	1676	1987
Domestically acquired infections (Source: Bacteriology Unit)												
Salmonella Typhimurium	222	137	132	241	170	150	80	134	132	94	98	94
Salmonella Enteritidis	42	61	81	75	69	61	49	48	44	47	83	46
Salmonella group B	3	2	7	1	4	11	5	7	8	40	35	38
Salmonella Infantis	4	4	4	11	6	3	7	2	9	10	36	12
Salmonella Agona	16	12	27	32	11	40	15	2	2	11	33	12
Salmonella Newport	3	16	8	3	9	23	70	9	8	6	7	11
Salmonella Thompson	0	2	2	2	3	0	3	2	12	2	5	9
Salmonella Abony	15	7	7	2	0	0	2	2	8	4	16	7
Salmonella Napoli	0	3	2	0	2	0	2	0	6	6	3	7
Salmonella Corvallis	0	3	0	1	1	1	2	2	3	1	2	6
Other	101	63	66	75	122	83	139	101	102	117	89	95
Total	406	310	336	443	397	372	374	309	334	338	407	337

infectious diseases by physicians, surveillance data for listeriosis will also be specified.

A total of 61 strains of *Listeria monocytogenes*, isolated from the patient's blood and/or cerebrospinal fluid, arrived for typing at a laboratory. The PCR method was used for determining the *Listeria monocytogenes* serotype. It was found that 47 (77%) of the strains typed were of serotype IIa (corresponding to serotype 1/2a and 3a when using the earlier method) and 14 (23%) were of serotype IVb (4b, 4d and 4e). These strains were divided into 38 PFGE genotypes. Typings revealed five domestic clusters of 3-4 strains (Asc 218-Apa 30, Asc 14-Apa 5, Asc 96-Apa 1, Asc 440-Apa 56, Asc 225-Apa 61), whose profiles were compared with Evira's database. Asc 218-Apa 30 strains were found in prepared salads and frozen mixes of peas, corn and paprika, while Asc 14-Apa 5 strains were found in salt-cured fish.

In 2013, up-to-date DNA typing data of *L. monocytogenes* strains was sent to the international database coordinated by the ECDC. So far, four international clusters that include DNA profiles of Finns have been found in the database. One strain is still being examined.

SALMONELLA

In 2013, a total of 1,987 salmonella cases were reported (2012: 2,194), of which 55 per cent were detected in women. Annual incidence in the entire country was 40/100,000 population. The incidence was highest in the Hospital District of Lapland (54/100,000) and lowest in Åland (21/100,000). The highest number of infections was reported in the 20 to 24 age group.

Nine cases of the S. Typhi bacterium, which causes typhoid, were identified. No information was available on a recent trip abroad in the case of two of the patients. One had arrived from India more than six months previously, while others had travelled in India, Nepal, Thailand or Kenya. Three cases were diagnosed of *S.* Paratyphi, which causes paratyphoid fever; two cases of *S.* Paratyphi B originated in Brazil and Bulgaria, and one *S.* Paratyphi A case originated in India.

Bacterial strains from a total of 1,777 cases of salmonella were typed at the National Institute for Health and Welfare: 1,413 (79%) were of foreign and 337 (19%) of domestic origin. The numbers of both domestic and foreign cases fell slightly over the previous year. The incidence of Salmonella infections contracted in the home country was 6.2/100,000 (in 2012: 7.5/100,000). In 27 (2%) cases, the origin of the salmonella infection remained unclear.

Domestic salmonella infections were caused by 60 different serotypes. The five most common included Typhimurium (94/337, 28%), Enteritidis (46), group B (38), Agona (12), Infantis (12) and Newport (11). Most (195/337, 58%) cases were still susceptible to all 12 antibiotics tested, but the share of multiresistants clearly rose compared to the previous year (2013: 70/337, 21% vs. 2012: 16%). The number of domestic cases in group B (38) is high for the third consecutive year. This increase is due to the monophasic *S.* Typhimurium of group B becoming more common. Most monophasic Typhimurium strains were multiresistant (87%); most commonly to ampicillin, streptomycin, sulfonamide and tetracycline. The most common phage type of monophasics has varied; in 2011 it was FT 195, in 2012 FT 193 and in 2013 FT 195 again, but the majority remained untyped for phages or the phage type was unnamed (NT or NST). The multiresistant monophasic Typhimurium strain (FT U311, MLVA 3-13-11-NA-0211) also caused an epidemic whose source remains unclear for the time being. Multiresistant FT 193, FT 195 and FT U311 strains are not known to occur in domestic production animals. Of other domestic strains of Typhimurium, 23% (22/94) were multiresistant. The traditional indigenous FT 1 phage type remained most common and its share is higher than in the previous year, but lower than a few years ago (2013: 27%, 2012: 23% and 2011: 60%). All FT 1 strains were susceptible to antimicrobials and divided into seven MLVA genotypes, of which, as in previous years, 3-16-NA-NA-0311 was the most common. Unspecified phage types that caused a reaction (FT NST, not specific type) were found in 14% of cases, as was phage type 120 (14%). The usual number of cases were caused by the domestic Enteritidis serotype (46). These were mainly susceptible to antimicrobials (33/46, 71%) and were divided between 12 different phage types. NT and NST strains accounted for 11% of cases. A total of 17 different PFGE genotypes were found in all, the most common being SENT 115 (65%), which was divided between four phage types and four MLVA types.

The salmonella infections acquired abroad represented 112 serotypes. The most common serotypes were the same as in two previous years: Enteritidis (479/1,413, 34%), Group B (158), Stanley (74) and Typhimurium (60). A total of 72% (383/532) of the strains originating in WHO/European countries (56 countries in Europe and the neighbouring areas) were of the Enteritidis serotype. An equal number of Enteritidis (16%, 126/811) and group B (15 %,

124/811) strains were brought in from outside the WHO/European countries. One half (705/1413) of the foreign strains were selected for antimicrobial susceptibility testing and further typing according to serotype. Selection focussed on strains originating in WHO/European countries, but was random with regard to serotype. The share of multiresistant strains had increased over the previous year, both in the WHO/European area (2013: 11% vs. 2012: 8%) and outside it (28% vs. 24%). Enteritidis strains originating in the WHO/European countries were divided into 21 phage types; 55% were of the phage type FT 14b or FT 8, whereas the Enteritidis strains of far-off countries were more evenly divided into 14 phage types. The group B strains (N=40) chosen for further typing and originating in far-off countries (most commonly Thailand) were mainly multiresistant monophasic *S.* Typhimurium strains (N=33). The most common phage type was FT 195 (N= 20).

SHIGELLA

In 2013, the incidence of shigellosis was 2.0/100,000. There were 110 reported cases, 51 in men and 59 in women. The median age in these cases was 35.5 years (variation 2–75). The majority of cases (77) were detected in individuals aged 20–59. More than half of the cases (59) were reported in the Helsinki and Uusimaa Hospital District. Seven hospital districts had no diagnosed cases. The lack of findings in so many hospital districts may well be indicative of problems in the primary diagnostics of shigella, which is known to require a high level of meticulousness when reading samples. Of the total, 91 infections (83%) were reported as having been acquired abroad, ten were contracted in Finland and, in nine cases, the country of acquisition remained unspecified. The most common countries of origin were Egypt (21 cases) and India (16). The prevailing shigella species were *Shigella sonnei* (74 cases) and *S. flexneri* (30 cases). *S. flexneri* was divided into six different serotypes, of which serotype 2a caused a local cluster in Turku in February–March and serotype 3a was connected to travel in Egypt in April.

Of the 2013 strains, 79% (2012: 80%) were multiresistant (R to at least 4 out of 12 antimicrobials tested), and 43% were completely resistant or had reduced susceptibility to ciprofloxacin (MIC 0.125–12 mg/l) (2012: 45%). Some of the strains from Egypt were susceptible to ciprofloxacin, but this was not true of any of the strains isolated from infections acquired in India. Three strains were susceptible to cefotaxime (infections from Afghanistan, China and Vietnam).

YERSINIA

Under the Communicable Diseases Decree, yersinia is among the bacteria that must be registered and reported to the NIDR, but does not need to be sent to the strain collection of the National Institute for Health and Welfare. However, species typing and biotyping/serotyping yersinia strains may pose a problem for clinical microbiology laboratories. Since the beginning of 2014, even problematic strains have not been routinely accepted.

Yersinia enterocolitica

In 2013, the NIDR received 497 reports of *Yersinia enterocolitica*, the same as in 2012 (497). The incidence for the entire country was 9.2/100,000. Based on the cases recorded in the NIDR, the incidence was highest in the over 75 age group (15/100,000) and lowest in the under 20 age groups. There was great regional variation in the *Y. enterocolitica* findings, the incidence being highest in the Helsinki and Uusimaa, North Ostrobothnia and Kymenlaakso Hospital Districts (16/100,000) and in the Länsi-Pohja Hospital District (15/100,000), while no cases were found in the Hospital District of Itä-Savo.

Y. enterocolitica is most commonly confirmed from a stool culture. In 2013, stool cultures were used for confirming 436 cases, while only 60 cases were confirmed by antibody findings in serum; in one case, both antibody typing and a stool culture were used. Since *Y. enterocolitica* typing results were reported for less than 50% of the cases confirmed using a stool culture, no conclusions can be drawn regarding the share of different bio/serotypes or the actual clinical significance of the findings. Of the 88 *Y. enterocolitica* strains submitted to the National Institute for Health and Welfare for typing, one half (51%) were of the biotype 1A. *Y. enterocolitica* strains of biotype 1A are a highly heterogeneous group of strains lacking the pYV virulence plasmid typical of pathogenic yersinias. Therefore the biotype 1A strains are considered non-pathogenic. However, some strains may have other properties affecting their pathogenic capabilities. A separate study found that *Y. enterocolitica* bacteria isolated from elderly patients in particular tend to be biotype 1A strains, while the pathogenic strains of bio/serotypes BT2/O:9 and BT3-4/O:3 are over-represented in small children.

Yersinia pseudotuberculosis

The number of *Yersinia pseudotuberculosis* cases (39) was lower than in the previous year (56). The majority of cases (33) were confirmed by culture and only 6 by antibody findings. In 2013, the incidence in

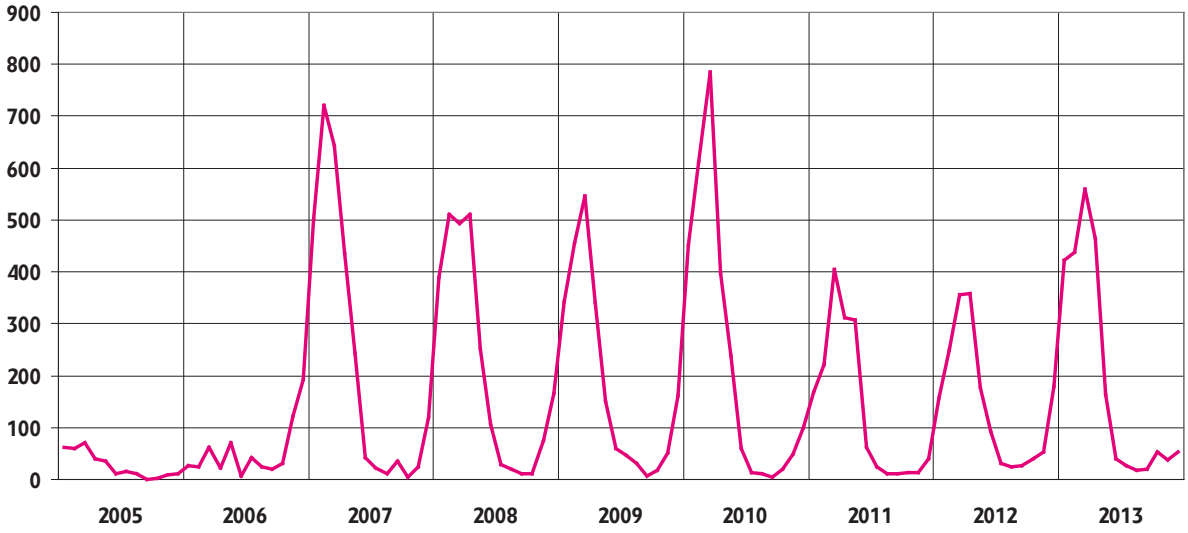


Figure 8. Cases of norovirus infection per month, 2005–2013 (no. of cases).

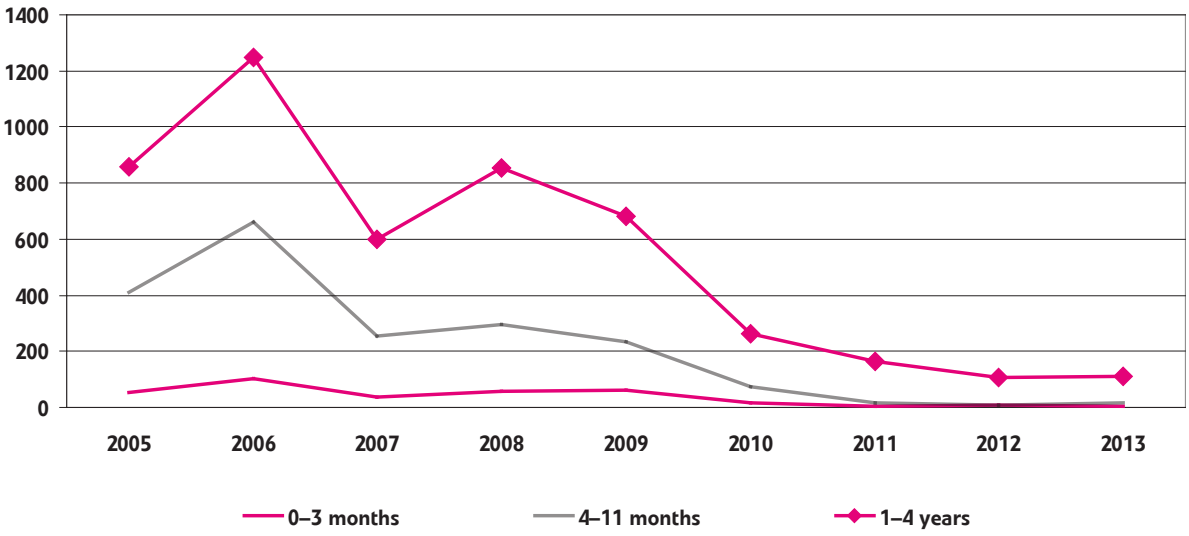


Figure 9. Rotavirus cases by age group in children aged 0 to 4, 2005–2013 (no. of cases).

the entire country was 0.7/100,000 population. The number of cases is too low to indicate any regional variation, and 12 hospital districts diagnosed no cases at all in 2013. In previous years, epidemics have caused high variation in the annual incidence of *Y. pseudotuberculosis* cases.

NOROVIRUS

In 2013, 2,296 cases of norovirus were reported, approximately 30% more than in 2012. Of these cases, 89% were reported in January–May and 1,281 (56%) in women. Although more than half (56%) of the patients were over 75 years of age, infections were diagnosed in all age groups. Cases were reported in all hospital districts.

The year 2013 was the sixth year running in which new variants of the norovirus GII.4 genotype, which emerge every one or two years, caused a widespread epidemic in Finland, as they did elsewhere in the

world. As in previous years (2007–2012), most of the epidemics that occurred in 2013 were institutional epidemics. This partly explains the high incidence among the elderly.

In 2013, epidemics were often caused by variants of norovirus GII.4 (GII.P4 Sydney 2012 or New Orleans 2009 or a variant formed due to the recombination of either of these). Individual epidemics caused by other genotypes (e.g. GI.Pb, GII.Pb, GII.P7) also occurred in 2013.

Norovirus has become one of the most common causes of food- or water-borne epidemics in the 2000s. In 2013, food-borne epidemics were caused by noroviruses of both genogroup I and genogroup II.

In May-June, a norovirus from genogroup I caused a major water-borne norovirus epidemic in a hotel in Espoo. The pathogen virus proved to be exceptional, as it was only found in further tests performed after ordinary diagnostics (for a more detailed description, please see the chapter Epidemics).

ROTAVIRUS

In 2013, 282 cases of rotavirus were reported. This is equivalent to the levels for 2011 and 2012. In recent years, the quantity of rotaviruses has been clearly lower than in 2006. 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 highest incidence by far again occurred in the under 5 age group (44/100,000), but this was clearly lower than the average incidence before the vaccination programme (460/100,000 in this age group). With increasing vaccination of infants, the percentage of cases in older age groups will increase. In 2013, 52% of all cases occurred in patients aged 5 or over, whereas this figure had never been higher than around 10% in previous years.

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 2013, cases were caused by rotavirus types G1P[8], G2P[4], G3P[8], G4P[8], G9P[8] and G12P[8].

Thanks to the rotavirus vaccination programme, vaccination coverage is high. An investigation is ongoing into whether the number of virus strains reduced due to vaccination or strains already destroyed are gradually being replaced by others. Rotaviruses were therefore included in microbial strain collection in accordance with the Communicable Diseases Act and Decree on 1 May 2013. This means that all faeces that tested positive in quick tests are sent to the virology unit of the National Institute for Health and Welfare for molecule genetic typing.

Hepatitis

- The number of hepatitis A cases was five times higher year-on-year. The exceptionally high number of cases was due to an epidemic that spread via frozen berries.
- Very few acute hepatitis B infections were reported.
- Hepatitis C infections were most prevalent in the 20 to 29 age group. Half of the infected patients in all age groups were intravenous drug users.

HEPATITIS A

In 2013, 41 cases of hepatitis A (0.8/100,000) were reported, five times more than in the previous year. The patients were equally divided, 22 men and 19 women. The median age in these cases was 25 years (variation 0–77). Cases of hepatitis A were found in 11 hospital districts, the highest number of being identified (20) in the Hospital District of Helsinki and Uusimaa and the second highest in the Hospital District of Vaasa (7). Of the infections, 20 were acquired in Finland and 12 abroad, while the location of infection was not reported for nine cases. The exceptionally high number of cases in comparison with previous years, and the high share of infections acquired in Finland was due to the fact that the epidemic spread through frozen berries. This epidemic caused cases not only in Finland, but also in other Nordic countries (see food-borne epidemics p. 13).

HEPATITIS B

In 2013, 20 acute hepatitis B infections were reported (0.4/100,000), 13 in men and seven in women. Sixteen of the infected patients were Finnish. The mode of transmission was known in 11 cases, being sexual contact in all but one. The country of acquisition was reported in 12 cases – six infections had been acquired in Finland, six abroad.

Today, the number of acute hepatitis B infections reported is significantly lower than in the late 1990s when, at most, over 200 infections were identified each year. This decrease is mainly due to higher vaccination coverage. Moreover, needle exchange has reduced the number of infections among users of intravenous drugs. Vaccination of risk groups began in the 1990s. The vaccine has been popular, particularly among travellers.

The number of chronic hepatitis B infections reported was 247 (4.6/100,000), 58% in men and 42% in women. The majority, 85% of infections, were diagnosed in foreigners. The mode of transmission was reported in only 16% of cases, with perinatal infections and infections due to sexual contact being most common.

The number of cases of chronic hepatitis B has decreased since it peaked at over 600 in 1996. However, this decrease has not been as sharp as that of the acute cases, probably due to the high share of foreigners.

The division of hepatitis B cases between acute and chronic cases has been specified: only cases in which the laboratory reports IgM antibodies (S-HBc-AbM) are presently classified as acute. The statistics for the years 2008–2013 have been amended, resulting in figures which differ from those previously reported.

HEPATITIS C

In 2013, 1,172 new cases of hepatitis C were reported to the NIDR (22/100,000), 66% of the patients being men and 34% women. The highest number of infections, 44% in all, were reported in the 20–29 age group. In this age group, infections have become slightly more common in recent years. In approximately one half of the cases, the reported method of transmission was intravenous drug use, in seven per cent sexual contact and for almost 40% of the cases the method of transmission was not reported.

The majority (83%) of hepatitis C infections were found in Finnish patients. The country of acquisition

was known in 60% of the cases. In 85% of the cases where the country of acquisition was known, the infection was contracted in Finland. The highest incidences in relation to population were reported in the hospital districts of Länsi-Pohja (39/100,000) and South Karelia (38/100,000) and the lowest in North Ostrobothnia (6/100,000) and Central Ostrobothnia (7/100,000).

The majority of hepatitis C infections were reported without an identity number until 1998. The high figures of hepatitis C in the late 1990s and early 2000s (1,400–1,900 cases) are due to changed reporting practices and cases reported in previous years being recorded as new ones. Since 2006, the annual number of cases has remained below 1,200, being at its lowest in 2009 (1,042) and increasing to close to 1,200 since then.

A very high percentage, around 80%, of intravenous drug users have been found to have hepatitis C antibodies. Because of this, it is difficult to reduce the incidence of hepatitis C virus further among intravenous drug users, despite needle and syringe exchange programmes.

Figure 10. Hepatitis C by age group, 2002–2013 (no. of cases).

Table 2. All cases of hepatitis C according to physicians' reports, by transmission routes, 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Injecting drugs	717	637	615	629	578	468	574	516	596	600	615	607
Sex	45	46	60	62	72	68	74	70	73	86	69	85
Perinatal	3	1	11	5	5	3	11	9	10	11	7	3
Blood products	19	22	18	24	7	21	20	2	9	7	7	9
Other	28	35	31	34	37	28	34	31	38	39	31	37
Unknown	560	524	506	490	469	577	429	422	406	417	450	445
Total	1372	1265	1241	1244	1168	1165	1142	1050	1132	1160	1179	1186

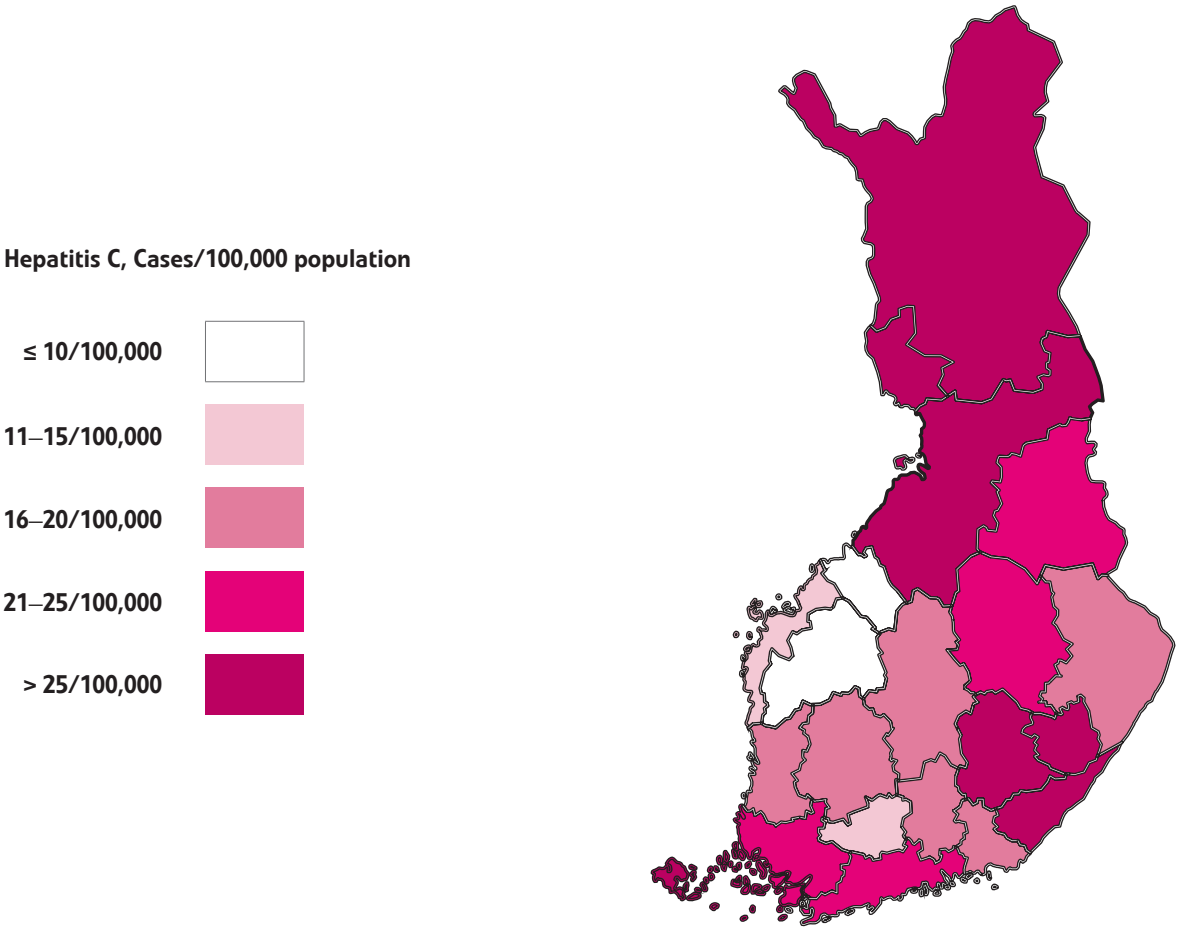


Figure 11. Incidence of hepatitis C in Finland in 2013, no. of cases per population of 100,000.

Sexually transmitted diseases

- Almost one half of gonorrhoea infections were contracted abroad, mainly in Thailand.
- More than one in three gonorrhoea infections were contracted through sexual contact between men.
- The number of HIV infections has not changed significantly in recent years. In addition, the number of AIDS cases and that of deaths from AIDS remained unchanged.

CHLAMYDIA (CHLAMYDIA TRACHOMATIS)

A total of 13,216 cases of chlamydia were reported (244/100,000), less than in 2012; 59% of the patients were women. The highest incidence was found in the Hospital Districts of Lapland (286/100,000), Helsinki and Uusimaa (285/100,000) and Päijät-Häme (283/100,000). The incidence was highest (42%) in women and men aged 20–24. Patients under the age of 20 accounted for 30% of the women (2,299) and 13% of the men (677).

Since 2011, cases of lymphogranuloma venereum (LGV) caused by *Chlamydia trachomatis* L1-3 immunotypes have been reported. In 2013, seven men were diagnosed with LGV.

GONORRHOEA (NEISSERIA GONORRHOEAE)

Fewer gonorrhoea infections were reported than in the previous year: 268 cases (4.9/100,000). Of these, 74 per cent were diagnosed in men. Most infections were found in the 20 to 24 age group, both in women (30%) and men (20%). The mode of transmission was reported in 81 per cent of cases, and 35 per cent of the infections in men were contracted through

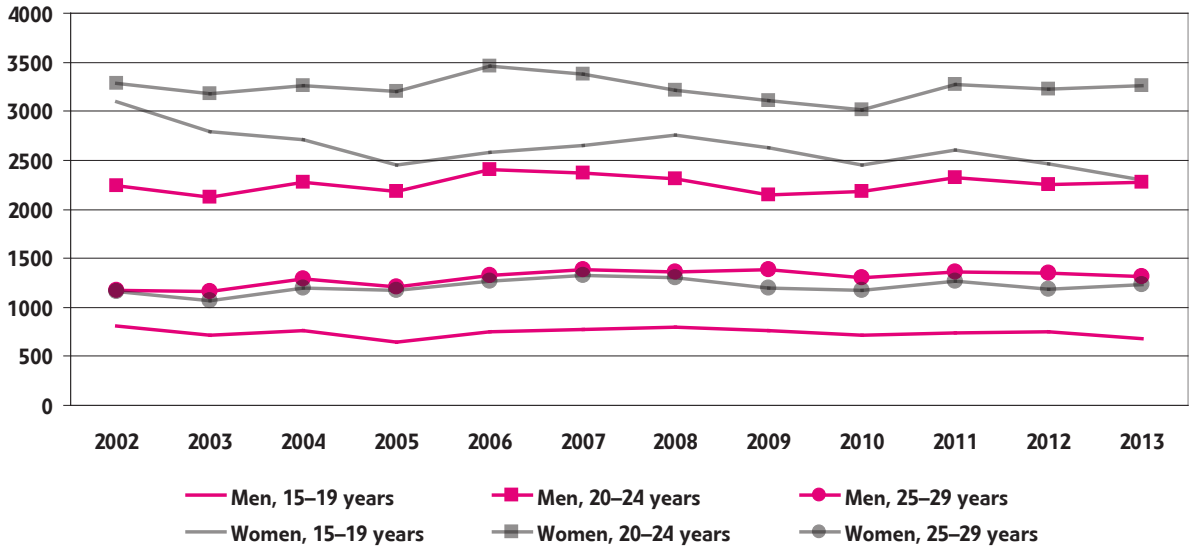


Figure 12. Chlamydia cases in the young adult age groups, 2002–2013 (no. of cases).

Table 3. Gonorrhoea infections acquired domestically and abroad, 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Finland	100	89	133	133	112	79	90	115	123	106	164	154
Thailand	31	27	38	30	42	44	34	36	45	35	35	31
Estonia	5	2	6	1	0	2	0	0	3	8	6	0
Russia	28	9	7	23	12	6	17	8	8	6	7	3
Other	18	21	21	20	25	22	24	40	33	41	55	49
Unknown	53	41	47	33	45	42	35	40	45	92	45	31
Total	235	189	252	240	236	195	200	239	257	288	312	268

Table 4. Syphilis infections acquired domestically and abroad, 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Finland	25	30	22	25	21	56	57	69	36	29	55	25
Russia	22	18	16	22	18	17	26	18	26	22	27	22
Thailand	0	1	2	1	1	2	6	5	4	5	6	5
Estonia	1	6	1	6	3	4	9	3	9	4	6	4
Other	14	16	12	21	20	29	43	40	50	45	41	28
Unknown	67	62	58	68	67	79	75	67	84	74	66	72
Total	129	133	111	143	130	187	216	202	209	179	201	156

sexual contact between men. The incidence was highest in the hospital districts of Helsinki and Uusimaa (11/100,000), Pirkanmaa (4.3/100,000) and Southwest Finland (3.8/100,000). The country of acquisition was specified in 88% of cases; 56 per cent of these infections having been contracted in Finland. The most infections were acquired in Thailand (31 cases).

In 2013, no Gonococcus strains resistant to ciprofloxacin were diagnosed.

SYPHILIS (TREPONEMA PALLIDUM)

In 2012, the number of syphilis cases reported totalled 157 (2.9/100,000), fewer than in 2012 (200). Men accounted for 64% of the cases, the number of infections being highest (15%) for men in the 40–44 age group and women (29%) in the 30–34 age group. The mode of transmission was reported in 33 per cent of cases, and one quarter of the infections in men were contracted through sexual contact between men. The incidence was highest in the hospital districts of South Karelia (6.0/100,000), Helsinki and Uusimaa (5.4/100,000), and Lapland (4.2/100,000). The country of acquisition was specified in 54 per cent of cases; in 16 per cent of these, the infection had been acquired in Finland. Russia was the most common foreign country of acquisition (22).

HIV AND AIDS

In 2013, 157 new HIV infections were diagnosed (incidence 2.9/100,000). In all, 16 cases of AIDS and eight deaths from AIDS were reported. No significant changes were found in infections, and the numbers of AIDS cases and deaths from AIDS also remained on a par with recent years.

Of the infections in 2013, 65% were diagnosed in men and 35% in women. The average age at the time of diagnosis was 39 years. The majority of infections were acquired through sexual contact. Foreigners accounted for 48% of all cases, of which 53% (5.8/100,000) were reported in the Hospital District of Helsinki and Uusimaa. The mode of transmission was unknown in 27% of cases, of which almost 80% were foreign.

A total of 67 infections, or 54% of all cases, were reported as having been contracted through heterosexual contact. Foreigners accounted for 45% of the infections and two in three infections were contracted abroad. Travel plays a key role in infections of Finns acquired through heterosexual contact.

A total of 43 infections, or 27% of all cases, were reported as having been contracted through sexual contact between men. Finns accounted for 93% of these cases, 39% of the infections having been acquired abroad.

Only three cases were diagnosed in which the infection was acquired through intravenous drug use. In all of these cases, the infected person was a foreigner. The exchange of needles and syringes, and HIV medication of infected patients have succeeded in keeping infections at a low level since the epidemic at the turn of the millennium.

One mother-child infection was reported. The child was born abroad. A total of 32 infections were detected in maternity clinic screenings and seven of these were new. In the other cases, the infection was known about before pregnancy. In the 2000s, all but one mother-child transmission have been of foreign origin. Mother-child transmission can be effectively prevented with HIV medication during pregnancy.

No infections caused by a blood transfusion were reported. There have been no reported cases of infection through blood products in Finland since HIV testing of donated blood began in 1985.

In 2013, 16 new cases of AIDS were reported, 12 in Finns and four in foreigners. The number of HIV-positive patients who died during the year was 21, the cause of death being AIDS in eight cases. Medication begun early enough effectively prevents deaths from AIDS.

As in earlier years, the percentage of late detection of infections (CD4 lower than 350) was high, at 52%. Late diagnosis weakens the treatment prognosis and increases the possibility of further infections. Preliminary analyses indicate that 4% of strain collection samples showed primary resistance mutations, at the same level as in the previous year.

By the end of 2013, the total number of HIV infections reported in Finland was 3,219. The reported number of HIV positive patients who died is 584, the cause of death being AIDS in 313 cases.

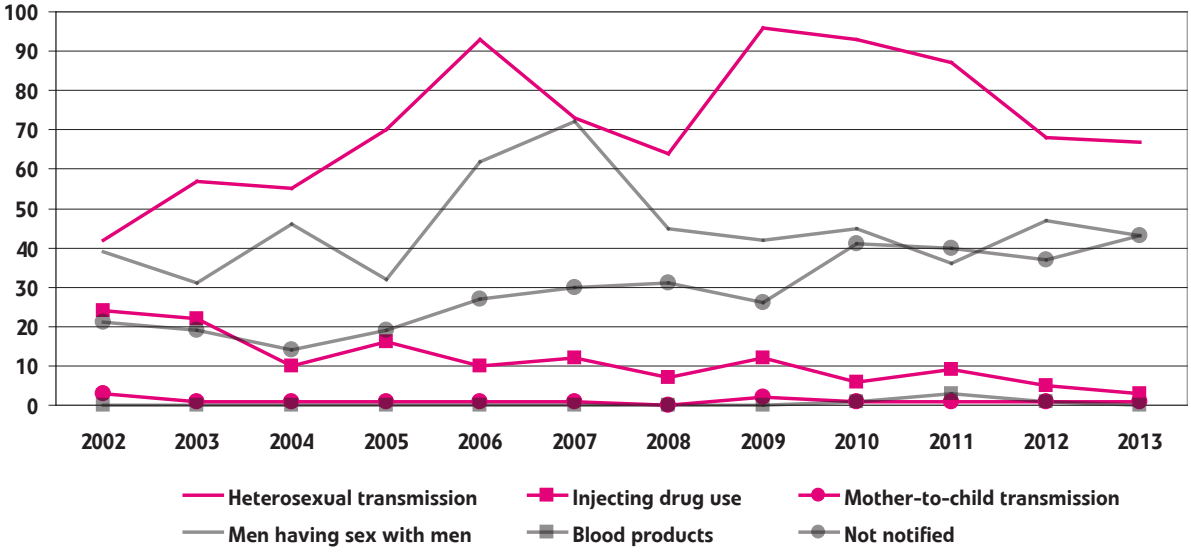


Figure 13. HIV cases by transmission route, 2002–2013 (no. of cases).

Antimicrobial resistance

- The number of MRSA cases and blood culture findings remained unchanged in comparison with previous years.
- The number of VRE cases decreased.
- The number of ESBL *E. coli* findings continued to grow.
- The majority of bacterial strains producing carbapenemase originated abroad.

MRSA

In 2013, 1,289 cases of methicillin-resistant *Staphylococcus aureus* (MRSA) were reported, about the same number as in the year before (2012: 1283). Also, the number of MRSA cases diagnosed using a blood culture was the same as in the previous year (2013: 30 and 2012: 30). Of these MRSA blood culture findings, 9 (30%) were in the Pirkanmaa Hospital District (1.8/100,000) and 9 (30%) in the Hospital District of Helsinki and Uusimaa (0.6/100,000). The other hospital districts reported zero to three cases each, totalling 12. Most (19 out of 30) of the invasive cases occurred in patients older than 65, and none in children. As earlier, the hospital districts of Pirkanmaa and of Helsinki and Uusimaa reported the highest total figures. The incidence was highest in the Pirkanmaa and South Ostrobothnia Hospital Districts. The percentage of findings in patients aged over 75 was 43, slightly more than before (37%). The number of MRSA cases in children did not increase (127-113).

The MRSA strain was typed in 1,330 individuals. There were 211 different spa types among the MRSA strains (2012: 186). The three most common spa types were the same as in the previous years. In 2013, the most common types were: t172 18% (2012: 17%), t067 16% (2012: 15%), t008 11% (2012: 12%), t032 4% (2012: 3%) and t044 3% (2012: 2%). t172 was found in 18 hospital districts whereas t067 was detected in eight hospital districts, most commonly in Pirkanmaa and South Ostrobothnia. The incidence of the strain t067 increased markedly in the Hospital District of South Ostrobothnia in 2013.

Moreover, local clusters were caused among others by t020 and t509 in the Hospital District of Helsinki and Uusimaa, t721 and t304 in the Hospital District of North Karelia and t1012 in the Hospital District of Pirkanmaa.

The most common spa type among patients over 75 was t067 (26%; 2012 27%). The most common spa types among children under the age of 16 were t172 (18%), t044 (13%) and t019 (7%). In 2012 too, t172 was the most common spa type among children (18%), followed by t657 (9%) and t008 (8%).

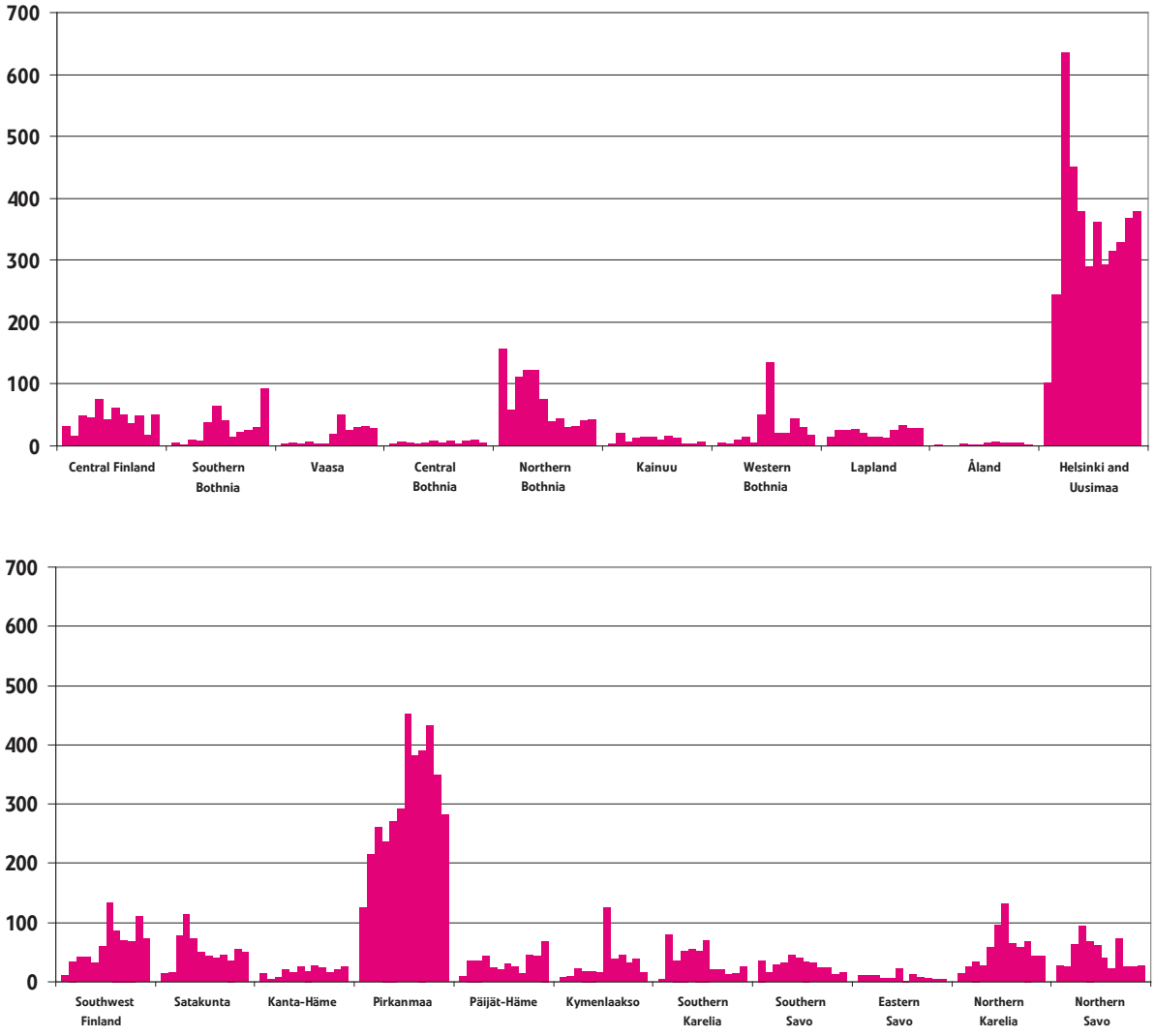
An MRSA strain isolated from the blood was typed in 25 individuals. Five of these were of spa type t067, three of spa type t008, two of spa type t172 and the remainder (15/25) featured different spa types.

In 2013, three MRSA strains with the *mecC* gene were isolated from clinical samples in the Hospital District of Helsinki and Uusimaa, Pirkanmaa and North Savo. Two of the strains were of the spa type t843 and one t742.

VRE

The number of reported cases of vancomycin-resistant enterococcus (VRE) in 2013 decreased on the previous year (2013: 45 and 2012: 93). The most cases were reported by the hospital districts of Helsinki and Uusimaa (17), North Ostrobothnia (7) and Central Ostrobothnia (7) (31/45) and in the over 65 age group (30/45). In other hospital districts, the number of findings varied from zero to three. Nine of the findings were blood culture findings (2012: 7).

VRE strains were typed in 33 individuals. As in previous years, most of the findings represented the *E. faecium* (28/33) species and the *van*B type (22/33). The new epidemic strain VRE XIII, representing the *E. faecalis* species, which spread in 2012 in the Kymen-



Figures 14a and 14b. MRSA cases by hospital district, 2002–2013 (no. of cases).

laakso Hospital District, was only detected in one individual in 2013. Almost all of the typed strains were individual findings with a specific pulsed field gel electrophoresis (PFGE) profile (28/33). Only individual cases of the most common strain types that had caused clusters in the two previous years were found in 2013: VRE VII (1/33), VRE X (2/33) or VRE XI (1/33).

ESBL

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

In 2013, the majority of ESBL findings were *E. coli* (4,445; in 2012: 3,688) and a small minority of *K. pneumoniae* strains (255; in 2012: 204). *E. coli* ESBL findings were made in all age groups, 76% in women and over half in patients aged 65 years or more. One half of diagnoses (50%, 2,226 /4,445) were made based on urine. The largest number of cases was found in the Hospital District of Helsinki and Uusimaa (1,370, 89/100,000), but the incidence was highest in the Lapland (128/100,000), Kymenlaakso (104/100,000) and North Karelia (103/100,000) hospital districts and in Åland (162/100,000). The number of blood findings was slightly higher than in 2012 (230 vs. 204) (the ESBL proportion in *E. coli*

Table 5. MRSA-findings and their percentage of S. aureus blood culture findings, 1995–2013 (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)
2012	1283	1488	30 (2,0)
2013	1289	1595	30 (1,9)

Table 6. E. coli findings with reduced susceptibility to third-generation cephalosporins (possible ESBL, extended-spectrum β-lactamase) and ESBL percentage, 2008–2013 (no. of cases and %).

	ESBL-findings	E. coli blood culture findings	ESBL E. coli blood culture findings and percentage of ESBL of E. coli
2008	1707	2813	42 (1,5)
2009	2158	2991	77 (2,6)
2010	2522	3211	112 (3,5)
2011	3119	3473	150 (4,3)
2012	3688	3448	204 (5,9)
2013	4445	3877	230 (5,9)

blood cultures: 230/3,877, 5.9% vs. 5.9% in 2012). Of these, 25% were in the Hospital District of Helsinki and Uusimaa. However, the incidence in blood culture findings was highest in the hospital district of Länsi-Pohja.

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 65%. More than one third of diagnoses (36%, 91/255) were made from urine. The largest number of cases was recorded in the hospital districts of Helsinki and Uusimaa (93) and North Ostrobothnia (26), while the incidence was highest in the hospital district of Lapland. Fifteen (2012: 17) of the findings were made from blood (the ESBL proportion in the *K. pneumoniae* -blood cultures: 15/570, 2.6% vs. 2012: 2.9%).

Table 7. K. pneumoniae findings with reduced susceptibility to third generation cephalosporins (possible ESBL, extended-spectrum β-lactamase) and ESBL percentage, 2008–2013 (no. of cases and %).

	ESBL findings	K. pneumonia blood culture findings	ESBL K. pneumoniae blood culture findings and percentage of ESBL of K. pneumoniae
2008	111	418	4 (1)
2009	154	480	6 (1,3)
2010	184	504	16 (3,2)
2011	244	449	16 (3,6)
2012	204	581	17 (2,9)
2013	255	570	15 (2,6)

CPE (carbapenemase-producing enterobacteria)

During 2013, 122 strains of *Escherichia coli*, *Klebsiella pneumoniae* and *Enterobacter cloacae* were examined for carbapenemase genes because of their reduced susceptibility to carbapenems. 21 of the strains studied had a carbapenemase gene and four strains of *E. coli* had an NDM gene. These strains were all of different sequence types (ST405, ST636, ST648 and ST940). In all cases, the patient had a contact with a foreign country (India, Croatia, Cambodia). Bacterial strains with NDM carbapenemase are common on the Indian Peninsula and endemic in the Balkans region. Two *E. coli* strains were diagnosed with OXA-48 carbapenemase, and in both cases the patients had a contact with a foreign country (Holland and Turkey). Fourteen strains of *K. pneumoniae* studied had a carbapenemase gene: two of them NDM, one OXA-48 and 11 KPC. The figures include ten *K. pneumoniae* strains resistant to carbapenems, isolated from a local epidemic and all found to have the KPC carbapenemase gene. The strains with the NDM gene were of the sequence type ST 231 and ST 11 and the patients had a contact with a foreign country (Thailand, India). Also, the OXA-48 positive strain was of the sequence type ST11 and the patient had received treatment in a hospital in Spain. The strains with the KPC gene were all of the sequence type ST512, which has not previously been found in Finland. It is related to and is believed to have originated from the *K. pneumoniae* ST258 strain, which is widespread around the world. The *K. pneumoniae* ST512 strain is known to have caused hospital epidemics in Israel and Italy. Patients diagnosed with these *K. pneumoniae* ST512 strains have had no contacts with foreign countries. In 2013, one strain of *E. cloacae* had KPC carbapenemase. Even in this case, the patient had a contact with a foreign country (Dominican Republic).

As in 2012, a major percentage of bacterial strains with carbapenemase were of foreign origin, but strains of Finnish origin were also found. In 2013, the first actual local epidemic was diagnosed in Finland. It should be noted that the bacterial strain that caused the epidemic was a sequence type, related to the highly communicable *K. pneumoniae* strain, that has been rare until now. Moreover, infection by these *K. pneumoniae* strains most probably occurred in Finland.

Tuberculosis

- One third of patients contracting tuberculosis were foreigners and most of the patients were aged between 15 and 44.
- Almost all *M. tuberculosis* strains were susceptible to drugs.
- Pulmonary tuberculosis treatment outcome surveillance for 2011 indicated that treatment outcomes were good in 69 per cent of the cases. This figure is on a par with the figures of most EU countries.

TUBERCULOSIS (MYCOBACTERIUM TUBERCULOSIS)

Tuberculosis monitoring

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 only included if the diagnosis was based on histology or a case of pulmonary tuberculosis was confirmed by positive sputum staining for tuberculosis bacilli.

From 2007 onwards, following the definition of tuberculosis cases in EU infectious disease monitoring, the statistics include all cases where a physician suspected tuberculosis on the basis of clinical evidence and decided to give full tuberculosis treatment even if the infection was not confirmed by microbiological tests or histology. The new grounds for compiling statistics do not affect the number of cases confirmed by laboratory tests or histology.

Incidence of tuberculosis 2013

There were 269 cases of tuberculosis (5.0/100,000), six cases fewer (2%) than in 2012 (275, 5.1/100,000). Of these, 213 (79%) were pulmonary tuberculosis, of which 91 (43%) produced a positive sputum stain test. There were 204 cases of tuberculosis confirmed by culture (76%), 20 fewer than in 2012 (224). According to physicians' reports, 17 patients (6%) 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 monitoring period. The number of these cases remained stable from 2007 to 2011 except in 2009, when an exceptionally large number of cases in foreigners was recorded; in 2012–2013, however, the figure was lower.

The distribution of cases by age group was as follows: under 15, 2 (1%); 15 to 29, 52 (19%); 30 to 44, 35 (13%); 45 to 59, 30 (11%); 60 to 74, 65 (24%); and over 75, 83 (31%). In half of all cases the patients were over 60 years of age, and most of them were born in Finland; their cases involved a reactivation of a latent infection contracted decades ago. Population reduction among the age groups in whose youth the incidence of tuberculosis in Finland was high has led to a notable decrease in the average age of tuberculosis patients between 2000 and 2013, from 64 to 57 years. No increasing trend has been found in children aged under 5 after the change to the vaccination programme in 2006.

The patient was reported to be foreign in 86 cases (32%), i.e. born abroad and assumed to have other than Finnish citizenship unless the data indicates otherwise. The distribution of these cases by age group was as follows: under 15, none; 15 to 29, 45 (52%); 30 to 44, 30 (35%); 45 to 59, 5 (6%); and over 60, 6 (7%). Among these there were 65 cases (76%) of pulmonary tuberculosis and 21 cases (24%) of other forms of tuberculosis. Information on the patient's country of birth or citizenship was missing in 2 cases (1%).

Table 8. Incidence of tuberculosis and percentage of culture-confirmed cases in Finland, 1995–2013 (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
2012	196	3,6	83	1,5	79	1,5	275	5,1	224	81,5
2013	213	3,9	91	1,7	56	1,0	269	5,0	204	75,8

In four (2%) of the tuberculosis cases reported in 2013, the patient also had an HIV infection. Two of these were new HIV infections reported in 2013, and two had been reported earlier. Two of the cases were foreign in origin.

Tuberculosis genotyping findings 2013

All new *Mycobacterium tuberculosis* strains were genotyped using the internationally standardised spoligotyping and MIRU-VNTR methods. In 2008–2013, of the total of 1,474 *M. tuberculosis* strains typed, 578 (39%) occurred in clusters.

The most common cluster in Finland is the Jazz cluster (SIT42), which has been spreading in the Helsinki metropolitan area for a long time. Four new cases were connected to this cluster in 2013. The second most common cluster is the SIT53, which is widespread in Denmark and Sweden. Six new cases in different parts of Finland were connected to this cluster. Four new cases emerged in the SIT53 cluster that had spread among socially marginalised people in the Tampere region. A total of twelve cases confirmed by culture were diagnosed in the epidemic that broke out in schools in Turku in 2012–2013 (the SIT149 cluster). Two cases of laboratory contamination were diagnosed through genotyping.

Tuberculosis strain susceptibility in 2013

The susceptibility of *M. tuberculosis* strains remains very good in Finland. Of all cultured strains, 95% had full susceptibility. Resistance to a drug was diagnosed in only ten cases. Two multi-drug resistant (MDR) cases were found during the year, both of Finnish origin.

Tuberculosis outcome surveillance in 2007–2011

Table 10 shows the distribution of treatment outcomes between 2007 and 2011. The domain consists of cases of pulmonary tuberculosis confirmed by

culture, genetic replication (PCR) or mycobacterial staining. Cases where the pathogen is an MDR strain are reported separately and are not included in Table 10. An outcome evaluation is performed 12 months after the sample is taken.

The treatment outcome was good in 69% of cases in 2011. It falls clearly short of the international target set by the WHO at 85% but is on a par with the average for most EU Member States. Mortality (before beginning treatment or during treatment) was 19%.

Table 9. Cases of tuberculosis in foreigners, 1995–2013 (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
2012	54	27,6	23	29,1	77	28,0
2013	65	30,5	21	37,5	86	32,0

Table 10. Results of outcome evaluation for treatment of microbiologically confirmed pulmonary tuberculosis, 2007–2011 (no. of cases and %).

	2007	2008	2009	2010	2011
Cases under surveillance	200	191	241	187	191
TREATMENT OUTCOME					
Favourable	144 (72%)	140 (73%)	167 (69%)	149 (80%)	132 (69%)
Cured	85	89	84	94	74
Treatment completed	59	51	83	55	58
Non-favourable	41 (21%)	37 (19%)	44 (18%)	22 (12%)	38 (20%)
Deceased	38 (19%)	33 (17%)	41 (17%)	18 (10%)	37 (19%)
Treatment failure	1	1	0	0	1
Interrupted treatment	2	3	3	4	0
Missing	15 (7%)	14 (7%)	30 (12%)	16 (8%)	21 (11%)
Transfer	2	2	13	4	7
Treatment continues at 12 months	7	9	9	8	8
Notified, as not known	1	3	2	1	5
Notification missing	5	0	6	3	1

Other infections

- Only six cases of severe pneumococcal diseases caused by vaccine serotypes were detected in under 2-year-olds. Of these, all but one were identified in unvaccinated children.
- The percentage of penicillin-resistant strains and those with reduced susceptibility began to decrease.
- The number of meningococcus infections decreased by one third in comparison with the three previous years.
- Only two cases of meningococcus were reported.
- The occurrence of borrelia has not increased in comparison with previous years.
- The number of tick-borne encephalitis (TBE) cases remained unchanged in comparison with previous years. Most cases of TBE were diagnosed in September.
- Approximately 50 per cent more cases of Puumala virus were reported than in 2012. The majority of patients were of working age.
- A total of 50 people were exposed to rabies abroad, mainly in Thailand and Russia. More than half of these were related to dog bites.

INVASIVE PNEUMOCOCCAL DISEASE (STREPTOCOCCUS PNEUMONIAE)

A total of 724 cases (13/100,000) of invasive pneumococcal disease, confirmed by a blood or cerebrospinal fluid culture, were reported (2012: 752, 14/100,000). As before, the incidence was higher among men than among women (15 vs. 12/100,000). The regional variation between hospital districts was approximately double (10–24/100,000), which may be due to differences in how actively blood cultures are being taken. Children under the age of 5 accounted for 4.6% of the patients and over 65-year-olds for 44.0%. The number of cases reported on the basis of antigen or nucleic acid detection totalled only 18. No serotype data is available for these cases and they are not included in the statistics.

In 2013, 721 cases of pneumococcal disease confirmed by culture were serotyped. These cases were divided into 40 serotypes or serogroups. Unlike in previous years, the most common serotype was 3 (12.2%), followed by 14 (9.9%), 22F (9.9%), 19A (9.4%) and 4 (8.8%). These five most common serotypes accounted for one half (50.3%) of all cases.

The 10-valent pneumococcal conjugate vaccine (PCV10) has been included in the basic vaccination programme for children since September 2010. The vaccines are administered at the age of 3, 5 and 12 months. The effectiveness of the vaccination programme is being monitored and the vaccination data of all children born on or after 1 June 2010, and who contract a severe case of pneumococcal disease, is investigated. In 2013, the number of severe cases of pneumococcal disease caused by the PCV10 vaccine serotypes (1, 4, 5, 6B, 7F, 9V, 14, 18C, 19F, 23F) decreased further compared to the years before the vaccine was introduced (2008–2009). In children under 2 years of age, six cases caused by PCV10 serotypes were diagnosed in 2013. All of these cases, except for one, involved children who had not yet been vaccinated because of their age or whose parents had not allowed them to be vaccinated. The number of cases caused by other than the PCV10 serotypes increased slightly in older age groups compared with the years before the vaccine was introduced.

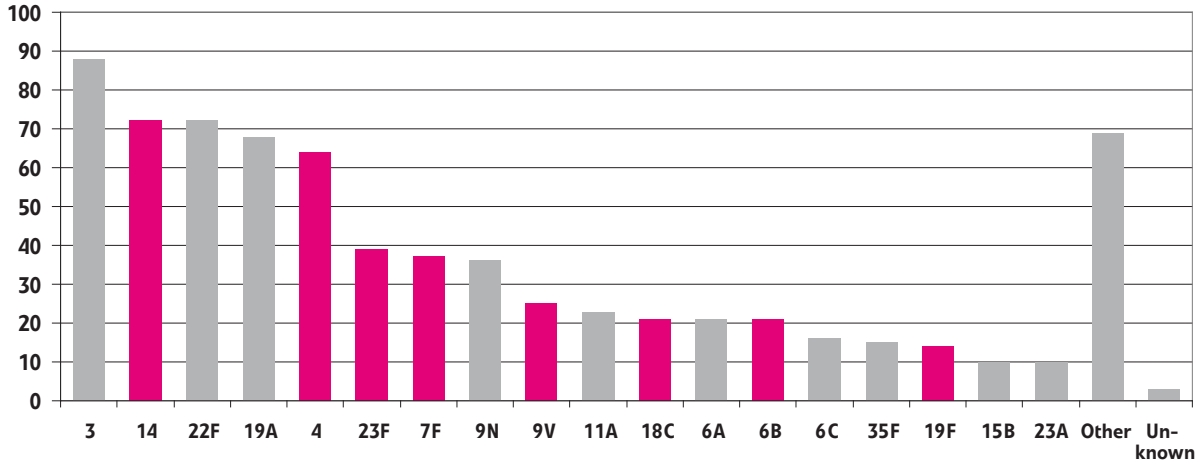


Figure 15. Serotypes of Streptococcus pneumoniae findings in blood and cerebrospinal fluid 2013 (no. of cases). PVC10-serotypes, red columns. The column "Other" includes serotypes that caused fewer than 10 cases.

Table 11. Streptococcus pneumoniae findings in blood and cerebrospinal fluid by age and vaccine serotype, 2008–2013 (no. of cases).

	PCV10 vaccine serotypes					Non-vaccine serotypes					Un-known
	<2	2–4	5–64	65–	Total	<2	2–4	5–64	65–	Total	
2008	49	26	305	198	578	13	6	177	118	314	34
2009	47	26	301	166	540	12	4	149	117	282	33
2010	51	35	253	167	506	8	5	155	123	291	39
2011	34	16	232	150	432	11	11	172	145	339	8
2012	8	15	192	147	362	7	2	178	180	367	21
2013	6	3	173	110	292	13	11	197	208	429	3

Antimicrobial sensitivity was determined for 668 strains of invasive pneumococcus (Table 12). Strains with reduced susceptibility to penicillin (MIC > 0.06 mg/L) accounted for 19% of the strains, and only one strain completely resistant to penicillin (MIC > 2 mg/L) was detected. The percentage of macrolide-resistant strains has also decreased further; 17% of invasive pneumococcal strains were resistant to erythromycin. Multiresistant strains (PEN IR-ERY R-TET R) accounted for 4% of the strains. No strains resistant to levofloxacin (MIC > 2 mg/L) were found in 2013. One strain was resistant to ceftriaxone (MIC > 2 mg/L) (0.2%). It seems that the share of penicillin-resistant strains and those with reduced susceptibility has begun to decline compared to 2012. The decline in macrolide resistance is also continuing.

HAEMOPHILUS (HAEMOPHILUS INFLUENZAE)

A total of 48 infections were caused by the *Haemophilus influenzae* bacterium and were diagnosed in blood or cerebrospinal fluid. This was on a par with the average rate in recent years, but was clearly less than in the peak year 2012 (81). More than one third of cases (38%) were diagnosed in patients aged 75 or older.

All cases were diagnosed through culture findings. The majority of these (38, 79%) were caused by unencapsulated strains of *Haemophilus influenzae*, as in earlier years. Serotype b caused an infection in a child under 2 years of age, serotype a in a one 6-month old baby and serotype f in five adults aged 38–78. Serotypes c, d and e did not occur at all. The serotype

Table 12. Antimicrobial resistance of Streptococcus pneumoniae findings in blood and cerebrospinal fluid, 1998–2013 (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
2012	751	754	22,2	27,7	5,0
2013	724	668	16,8	18,7	4,0

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

of three cases remained unknown because the strains were not received for typing by the National Institute for Health and Welfare.

In the case of serotype b, the patient was a 2-year-old unvaccinated child diagnosed with severe epiglottitis. The vaccination programme designed to limit carriage of the bacteria in the throat has succeeded in limiting the circulation of serotype b in the population, but cases can still occur in children with incomplete vaccination coverage.

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 in 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 2013, the number of meningococcus infections detected in blood or cerebrospinal fluid totalled 20 (0.37/100,000), which is more than a third less than in the previous three years (Table 13). All cases were diagnosed through a culture finding, and all strains were serogrouped and genotyped. Ten (50%) were of serogroup B, 8 (40%) of serogroup Y, and 2 (10%) of serogroup C.

Unlike in previous years, no meningococcal infections were found in 5–29-year-olds. One half (10, 50%) of the cases were diagnosed in 0–4-year-olds and one half (10, 50%) in patients over 30. The majority (80%) of cases caused by meningococcus of serogroup B were diagnosed in young children, whereas all caused by group Y were in older age groups.

Genotyping showed that the group B strains were divided into eight types. The most common type was B:P1.7-2,4:F1-5, which caused an infection in two children and one adult in various parts of the country. In 2012, the same aggressive strain infected four

Table 13. Meningococcal infections by serogroup, 2002–2013 (no. of cases).

	Group A	Group B	Group C	Group Y	Group W135	Unknown	Total
2002	0	34	9	4	1	3	51
2003	0	36	6	4	1	2	49
2004	0	28	5	6	0	2	41
2005	0	29	5	4	2	4	44
2006	0	33	1	3	0	3	40
2007	0	38	5	1	0	1	45
2008	0	29	8	5	0	1	43
2009	0	19	8	2	0	0	29
2010	0	14	4	13	1	3	35
2011	0	19	6	7	1	1	34
2012	0	17	3	8	1	4	33
2013	0	10	2	8	0	0	20

people and in 2011, ten. Other strains of group B caused individual cases. Five types of group Y strains were identified. As in previous years, Y:P1.5-1,10-1:F4-1 was most common, causing an infection in three adults in various parts of the country. The group C strains were divided into two types.

Early in 2013, a cluster caused by group B meningococcus was diagnosed in southern Finland, causing a severe infection in three small children. However, genotyping showed that the cases were caused by different strains. In July 2013, infections caused by the same strain Y were detected in two adults in Southwest Finland, but no epidemiological connection was found between these two cases.

In sporadic 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 the meningococcus serotype groups A, C, W135 and Y and the Defence Forces is administering a quadrivalent polysaccharide vaccination to all recruits. Otherwise, meningococcus vaccines are mainly used in connection with epidemics and travel. A new vaccine against group B meningococcus strains is coming on the market.

MMR DISEASES (MEASLES, MUMPS, RUBELLA)

In 2013, two cases of measles were reported, on a par with recent years, but clearly less than in the peak year 2011 (27). Both patients were adults, one vaccinated as recommended and the other unvaccinated. One had travelled in South East Asia and the other had a contact with a person visiting Finland who was infected with measles.

One case of mumps in an adult was reported in 2013. Prior to falling ill, the patient had travelled in England and was reportedly unvaccinated.

Two cases of rubella were diagnosed in Finland in 2013, both in unvaccinated guest workers.

VARICELLA VIRUS

The number of varicella findings reported to the NIDR was slightly lower than previously at 455 (2012: 489). Of these findings, 227 were diagnosed by antigen detection, 98 by nucleic acid detection and 146 by serological diagnostics. There were 42 (9%) reports based on a diagnosis from cerebrospinal fluid, involving the identification of a varicella nucleic acid in 39 cases, a varicella antigen in three cases and varicella antibodies in nine cases.

The patients were aged between 0 and 92. Childhood varicella or chicken pox is a very common disease, with an estimated 57,000 cases in Finland every year.

It is mostly diagnosed clinically and does not even lead to a health care contact in the majority of the cases. By contrast, herpes zoster, or shingles, causes far more use of health care services especially in the elderly, and this can be seen in the age distribution of virus findings. The incidence was 8/100,000 on average, being highest in the over 65 age group: 14/100,000 in the 65 to 69 age group, 13/100,000 in the 70 to 74 age group and 15/100,000 in the over 75 age group. Currently, varicella vaccination is recommended to everyone aged 13 or over who has not had chicken pox.

BORRELIA (LYME DISEASE)

A total of 1,707 cases of borrelia were reported, roughly on a par with previous years (2012: 1,587, 2011: 1,662 and 2010: 1,442). Of these reports, 27 were based on nucleic acid detection and 1,670 on a serological test. The incidence in the whole country was 31/100,000 on average, but there was significant regional variation. The incidence was highest in the Åland Islands (1,621/100,000), accounting for more than a quarter of all diagnosed borrelia infections in Finland, 462 cases. As previously, the frequency of borrelia was highest in the autumn, from August to November. The majority of the patients (76 %) were aged over 45; 51 % of the patients were women.

TICK-BORNE ENCEPHALITIS (TBE)

In 2013, 38 TBE antibody findings were reported to the National Infectious Diseases Register, similar to the figures for previous years. Positive TBE findings were reported between May and October, the largest number being reported in September. The patients who contracted TBE were aged between 1 and 76.

In order to identify the place of acquisition, the National Institute for Health and Welfare interviewed patients who had been diagnosed with TBE in 2013

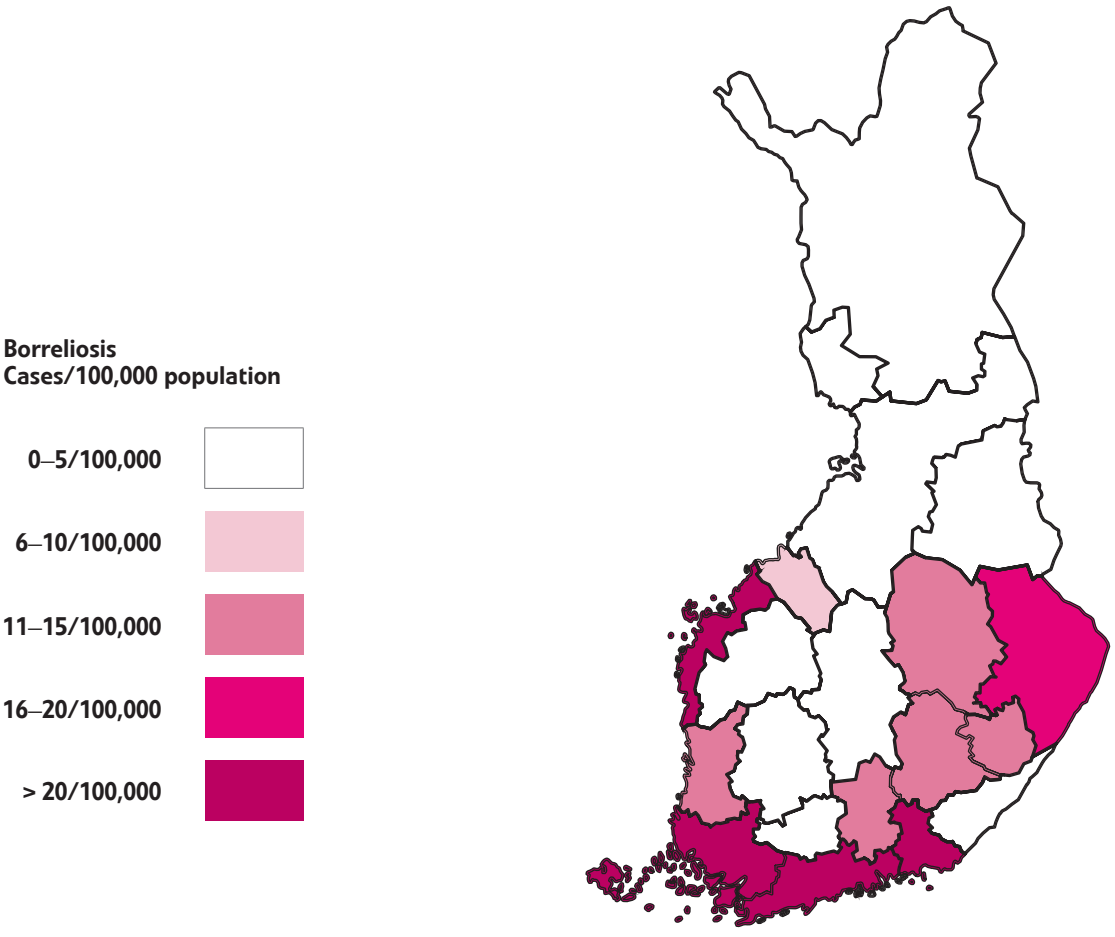


Figure 16. Borrelia cases by hospital district, 2013 (no. of cases/100,000).

and/or studied their patient records. Nine patients contracted TBE on Åland, 25 in mainland Finland and four patients contracted TBE in areas with high incidence of TBE in Sweden, Switzerland, Estonia and Austria. All residents of Åland have been entitled to a TBE vaccination free of charge since 2006. However, two Åland residents were infected regardless of the vaccination.

Some of the cases in mainland Finland originated in previously known TBE risk areas: Parainen (6), Lappeenranta region (4), Simo (2) and the Kokkola/Luoto archipelago (1). Hanhikivi in Pyhäjoki arose as a new probable area in terms of TBE infection (3) but individual infections were detected in other localities, including Outokumpu, Kuhmoinen, Espoo and Hanko, although no proof of a permanent risk of infection is as yet available.

In addition to this year's cases, previously identified places of infection include Närpiö, Maalahti and the Kotka and Sipoo archipelago, and the Kuopio region. As well as in Åland, the TBE virus was identified in ticks in the Turku archipelago and the Lappeenranta region decades ago, and in collections performed in the following risk areas in recent years: Isosaari in Helsinki, the Kokkola archipelago, Maksniemi in Simo and the Kotka archipelago.

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.

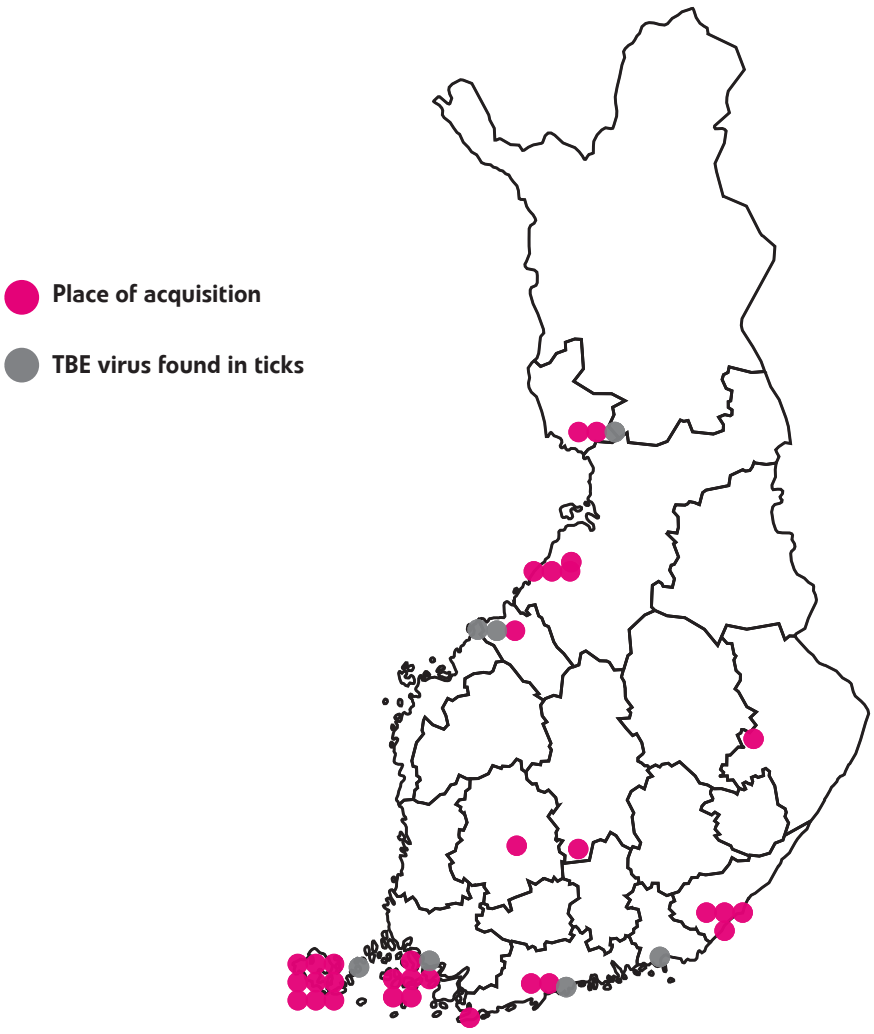


Figure 17. Cases of TBE by location of acquisition, 2013, and TBE virus findings in ticks, 1996–2013.

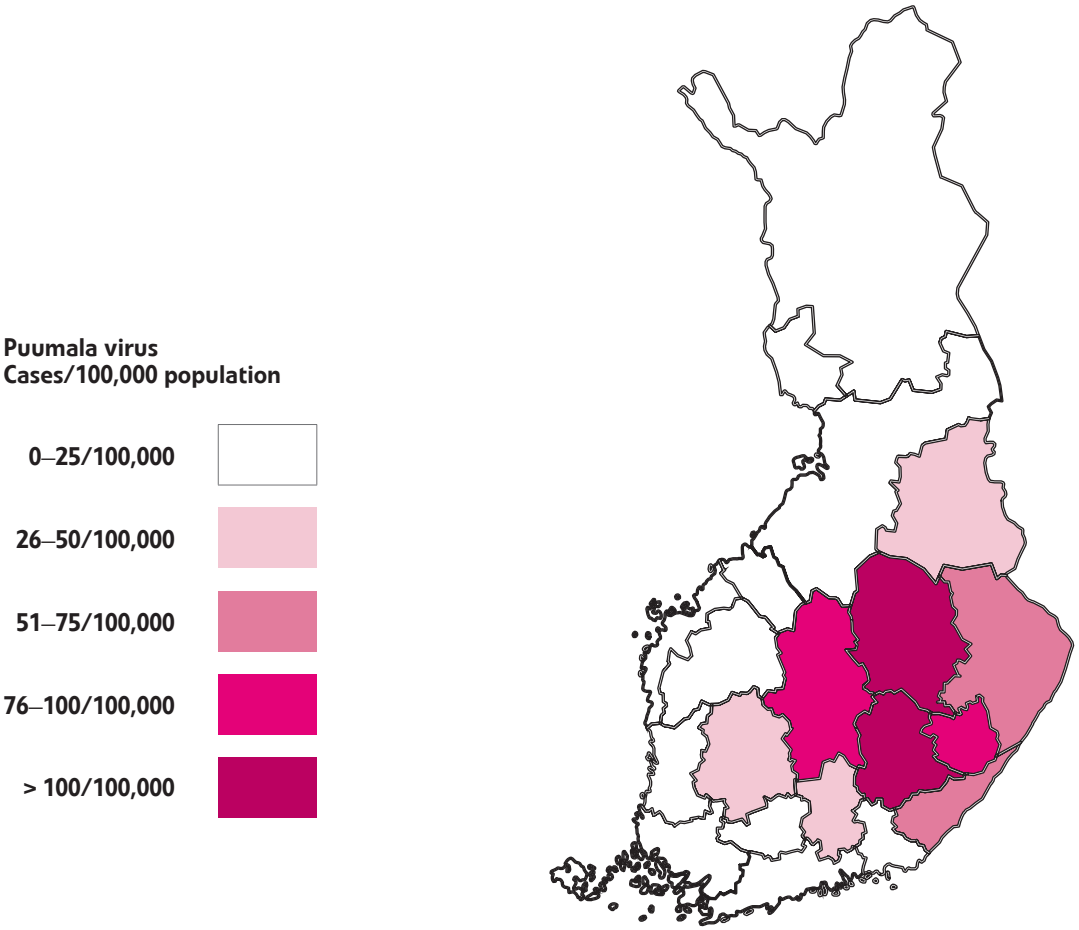


Figure 18. Cases of Puumala virus by hospital district, 2013 (no. of cases per 100,000 population).

PUUMALA VIRUS

In 2013, a total of 1,685 cases of Puumala virus were reported (31/100,000), which is about fifty percent more than in 2012 (841). The annual 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. The previous peaks occurred in 2002, 2005 and 2008, with a slight increase also in 2011. Of the patients, 58% were men, and most patients were of working age. There were 77 (4.6%) under 20 years of age. The incidence was highest in the Etelä-Savo Hospital District (151/100,000) and the Pohjois-Savo Hospital District (133/100,000).

POGOSTA DISEASE (SINDBIS VIRUS)

There were 99 cases confirmed with antibody testing, clearly less than in the previous year (2012: 189). The incidence was highest in the hospital districts of Central Ostrobothnia and Vaasa (9.3 and 5.9 / 100,000, respectively). Of the patients, 82 (83%) were of working age, aged 20 to 64, and 60 (61%) were women. The majority of the cases, 89 (90 %), were diagnosed between July and September.

The Sindbis virus is principally transmitted by mosquito species prevalent in late summer. 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 in the incidence of the disease in Finland. Cases

of Pogosta disease tend to cluster in the period from late July to September.

A Sindbis infection that presents with symptoms is more common in Finland than elsewhere in the world. The virus has an incubation period of one week, after which the infection presents with a fever commonly accompanied by rash and muscle and joint symptoms. The joint pain may persist for years in some patients, and is not always easy to associate with Pogosta disease. Genetic susceptibility is probably a factor both in contracting the infection and in the presentation of symptoms.

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).

Table 14. Malaria cases in Finland in 2013 by country of acquisition.

Continent	Country	Cases
Asia	India	2
	Pakistan	1
	Total	3
Africa	Southern Sudan	2
	Ethiopia	1
	Gambia	4
	Ghana	3
	Cameroon	4
	Kenya	4
	Mali	1
	Mauritania	1
	Nigeria	8
	Ivory Coast	1
	Zambia	1
	Sierra Leone	3
	Tanzania	1
	Chad	1
	Uganda	1
	Total	36
Oceania	Papua New Guinea	1
	Total	1
Total		**40**

TULAREMIA (FRANCISELLA TULARENSIS)

In 2013, a record low number of tularemia cases, only 15, were reported (incidence 0.28/100,000). Of these, four were detected in the South Ostrobothnia and four in Central Finland Hospital District, others being distributed as individual cases in different hospital districts. Twelve cases (86%) were diagnosed in men, the majority, 11 cases, being diagnosed in July–September.

The annual incidence of tularemia varies considerably (between 0.3 and 18/100,000). Epidemics, which occur in a cycle of a few years, tend to be local. Because tularemia bacteria are mainly transmitted by insect bites, the incidence of the disease peaks in late summer. So far, it is unknown what local ecological circumstances might explain the differences in incidence between hospital districts.

RABIES

Doctors are required to report cases where risk assessment has led to the start of rabies vaccination treatment after exposure. In 2013, 88 reports were made, clearly more than in 2012 (56). A further six suspected cases were reported in the Helsinki and Uusimaa Hospital District in which the exposure had occurred in 2012. These suspected cases are not included in the following figures.

There were 50 patients who had been exposed abroad: 19 in Thailand and ten in Russia and more than one case of exposure in Turkey, Estonia, Greece and India, respectively. More than a half of the cases of exposure were related to dog bites. Exposure in Finland was reported in 38 cases, of which 18 (47%) were associated with a dog bite. In all cases of exposure in Finland involving a dog, the dog had been imported to Finland from a country where rabies occurs. Seven cases of exposure involving a bat were reported, and three involving accidental exposure to rabies bait vaccine.

MALARIA, DENGUE FEVER AND OTHER TRAVEL-RELATED INFECTIONS

Malaria

Malaria was diagnosed in 40 patients in Finland in 2013. There were 27 cases of *Plasmodium falciparum*, one case of *P. falciparum-P. ovale* double infection, and six of *P. vivax* and six *P. ovale*. Most infections were

contracted in Africa (36 cases, or 90%), 26 in western Africa. Three infections were acquired on the Indian subcontinent, and one in Oceania. Of the patients, eight (20%) were native Finns who had been travelling in a areas with malaria for less than six months, and four were Finns resident in a malarious area; 21 (53%) were immigrants from a malarious area who had been visiting their home country, six were immigrants who had fallen ill immediately after arriving in Finland, and one was a visitor to Finland. The countries in which patients contracted malaria and the risk groups remained approximately the same as in previous years.

Dengue fever

Dengue fever cases have been on the increase in recent years, with 35 to 50 cases per year. Some 90 cases were reported in 2012. The corresponding figure for 2013 was 80, of which the majority (75/80) occurred in 15–59-year-olds. In addition, five cases were diagnosed in 60–74-year-olds, but none in the under 15 or over 75 age groups. The majority were diagnosed in January, February and March. Comprehensive data on the countries of acquisition is not available.

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; data on the country of acquisition and means of transmission is discussed separately for each of these diseases in its respective section.

BLOOD AND CEREBROSPINAL FLUID FINDINGS IN CHILDREN

Blood culture findings in children

The number of blood culture positive cases reported in children under 15 in 2013 was 386, slightly less than in recent years (average between 2000 and 2012 was 600, variation 426–686).

Approximately one half of the findings (192 out of 386) were in babies under 12 months old. Among infants, *Staphylococcus epidermidis* and other coagulase-negative staphylococci caused 37% of blood culture positive infections (table 15). Though these bacteria belong to the normal skin flora, they typically cause late-onset sepsis in newborn babies in intensive care. The second most common cause (16% 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* (19% of the findings), *Staphylococcus aureus* (9%) and *Streptococcus pneumoniae* (4%).

In the age group 1 to 14 years, *S. aureus* was the most common cause of blood culture positive infections in 2013 (25%) (Table 16). As in 2012, the incidence of the previous leading cause, *S. pneumoniae*, was less than half of what it had been in previous years (18%). A pneumococcus vaccination for children was added to the national vaccination programme in 2010. Other common findings in this age group were coagulase-negative staphylococci (17%), the *Streptococcus viridans* group (5%) and *E. coli* (5%).

Cerebrospinal fluid 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 total number of cases reported in 2013 was 21 (the annual average from 2000 to 2012 was 35, variation 18–56), of which 10 were diagnosed in infants under 12 months old. The most common findings in the under 12 month age group were meningococcus, *S. epidermidis* and *S. pneumoniae* (Table 17); in the 1 to 14 year age group, *S.pneumoniae* and meningococcus were most common (Table 18).

GBS in newborns

Between 1995 and 2012, an average of 32 cases per year of early-onset GBS in newborns (diagnosed from blood and/or CSF in children under the age of 7 days) were reported; the variation was 20 to 57 cases per year, and the incidence was 0.3 to 1.0 per 1,000 live births. There were 20 cases in 2013 (0.3 cases per 1,000 live births). An average of 15 annual cases of late GBS disease cases detected at the age of more than 7 days have occurred during the fifteen-year surveillance period (range 6–24; incidence 0.1–0.4 cases per 1,000 live births). There were 11 cases in 2013 (0.2 cases per 1,000 live births).

Table 15. Blood culture findings in infants (under 12 months), 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Staphylococcus epidermidis	76	61	110	98	100	92	87	64	71	76	50	47
Escherichia coli	40	39	37	41	44	42	38	38	45	48	25	36
Streptococcus agalactiae	46	37	45	73	55	51	49	51	54	42	36	31
Staphylococcus, other coagulase-negative	35	20	36	31	41	39	33	43	32	33	26	24
Staphylococcus aureus	24	21	32	32	37	25	23	22	24	21	31	18
Streptococcus pneumoniae	17	25	28	26	27	21	26	25	20	11	8	8
Streptococcus viridans group	8	13	15	12	10	9	8	9	18	11	3	5
Klebsiella species	7	8	9	9	8	6	8	9	3	7	6	4
Neisseria meningitidis	2	2	5	3	2	3	3	5	4	1	2	4
Enterobacter species	6	6	5	3	13	8	6	3	3	10	5	3
Acinetobacter species	4	3	1	1	3	2	1	1	3	2	1	2
Bacillus	0	1	2	2	1	4	4	2	1	1	1	1
Haemophilus influenzae	0	4	1	2	1	1	2	2	1	0	4	1
Listeria monocytogenes	0	0	0	0	2	1	0	1	2	0	1	1
Salmonella, other than Typhi	1	0	0	0	0	0	0	1	0	1	0	1
Serratia species	5	2	4	0	2	3	4	1	2	4	0	1
Streptococcus pyogenes	1	1	3	0	0	3	2	4	2	0	6	1
Bacteroides fragilis group	0	0	0	0	0	1	1	0	1	0	0	0
Citrobacter species	1	1	0	1	1	0	0	1	1	0	1	0
Clostridium perfringens	1	0	0	1	0	0	0	0	0	0	0	0
Clostridium, other or unidentified	0	1	1	0	2	0	1	1	1	0	2	0
Enterococcus faecalis	11	11	9	15	22	8	5	10	20	12	11	0
Enterococcus faecium	2	2	3	2	3	0	1	2	2	1	0	0
Enterococcus, other or unidentified	0	0	1	0	0	0	0	2	0	0	1	0
Haemophilus, other than influenzae	0	1	0	1	1	0	1	0	0	1	0	0
Morganella morganii	0	0	0	0	0	0	0	0	0	0	0	0

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Peptostreptococcus and Peptococcus	0	0	0	0	0	0	0	0	1	0	0	0
Prevotella species	0	0	0	0	0	0	1	0	0	0	0	0
Propionibacterium species	1	0	0	0	0	1	0	0	0	1	0	0
Proteus mirabilis	0	0	1	0	1	1	0	0	0	0	0	0
Proteus vulgaris	0	0	0	0	0	0	0	0	0	0	0	0
Pseudomonas aeruginosa	1	1	4	0	0	0	2	0	2	1	0	0
Stenotrophomonas maltophilia	1	1	0	1	0	2	0	2	2	0	0	0
Streptococcus bovis group	1	1	1	1	0	0	0	2	0	0	0	0
Streptococcus milleri group	1	0	0	0	1	0	0	0	0	0	0	0
Streptococcus, other beta-haemolytic	1	1	2	0	1	0	0	3	2	0	1	0
Veillonella species	0	0	0	0	1	0	0	0	0	0	0	0
Other bacteria	12	9	8	4	5	10	7	5	4	10	6	3
Bacteria, total	305	272	363	359	384	333	313	309	321	294	227	191
Candida albicans	10	2	3	4	4	2	3	1	2	1	1	1
Other candida species	8	2	0	1	0	1	1	0	0	1	2	0
Other fungi	0	0	0	0	0	1	0	0	0	0	0	0
Fungi, total	18	4	3	5	4	4	4	1	2	2	3	1

Table 16. Blood culture findings in children (aged 1 to 14), 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Staphylococcus aureus	58	47	58	41	37	43	40	36	43	42	47	48
Streptococcus pneumoniae	92	94	88	101	99	115	87	92	95	74	35	35
Staphylococcus epidermidis	40	30	25	41	40	33	22	31	37	29	17	25
Streptococcus viridans group	13	13	18	24	24	23	21	25	36	20	14	16
Escherichia coli	13	13	15	10	16	12	14	12	15	11	14	9
Staphylococcus, other coagulase-negative	14	16	9	13	8	18	13	16	21	13	11	8
Streptococcus pyogenes	10	12	4	0	9	13	11	11	6	16	9	8
Bacillus	5	6	2	7	6	0	6	3	3	2	5	5
Pseudomonas aeruginosa	4	6	3	6	3	2	1	3	7	4	3	4
Salmonella, other than Typhi	1	1	1	1	2	5	2	0	6	2	3	4
Acinetobacter species	8	2	1	4	1	2	2	4	1	0	1	3
Haemophilus influenzae	1	6	0	1	1	2	3	3	2	5	0	3
Klebsiella species	6	4	5	10	3	6	5	2	4	2	6	3
Neisseria meningitidis	8	6	2	7	5	3	4	0	6	2	2	3
Fusobacterium species	3	0	1	2	3	5	5	1	1	1	1	1
Haemophilus, other than influenzae	0	0	0	0	0	0	0	0	0	0	1	1
Listeria monocytogenes	0	1	0	0	0	0	0	0	0	0	0	1
Propionibacterium species	0	1	0	0	0	0	0	0	0	0	2	1
Salmonella Typhi	1	1	1	2	0	2	0	0	0	2	0	1
Serratia species	1	0	0	1	2	1	0	0	1	0	0	1
Stenotrophomonas maltophilia	0	1	3	0	1	3	4	2	2	0	1	1
Bacteroides fragilis group	1	0	2	3	0	0	0	1	0	2	0	0
Bacteroides, other than fragilis group	0	0	0	0	0	0	0	0	0	0	0	0
Campylobacter species	0	0	0	0	0	0	0	0	0	0	0	0
Citrobacter species	1	0	0	1	0	2	2	1	1	0	0	0
Clostridium perfringens	0	1	0	0	1	2	0	1	1	0	0	0

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Clostridium, other or unidentified	2	1	0	3	2	4	1	1	2	1	2	0
Enterobacter species	1	6	3	3	1	2	4	3	2	3	1	0
Enterococcus faecalis	4	2	2	4	2	6	6	4	6	3	5	0
Enterococcus faecium	4	1	2	2	3	4	2	7	7	0	1	0
Enterococcus, other or unidentified	0	2	2	0	2	2	3	0	1	0	0	0
Mycobacterium, other or unidentified	0	0	0	0	0	0	0	0	0	1	0	0
Peptostreptococcus and Peptococcus	0	0	0	0	0	0	0	0	0	2	1	0
Prevotella species	0	0	1	0	0	0	0	0	0	0	0	0
Proteus mirabilis	0	0	1	0	0	1	0	0	0	0	0	0
Pseudomonas, other than aeruginosa	1	1	0	1	0	1	0	3	0	0	0	0
Streptococcus agalactiae	0	2	1	0	0	2	1	0	0	0	0	0
Streptococcus bovis group	0	0	0	0	1	0	0	0	0	0	0	0
Streptococcus milleri group	1	0	0	3	2	0	2	2	2	1	1	0
Streptococcus, other beta-haemolytic	0	3	2	2	4	1	0	2	2	1	1	0
Veillonella species	0	0	0	0	1	0	0	0	1	0	0	0
Yersinia pseudotuberculosis	0	1	0	0	0	0	0	0	0	0	0	0
Other bacteria	16	11	18	22	14	15	10	10	24	10	11	10
Bacteria, total	309	291	270	315	293	330	271	276	335	249	195	191
Candida albicans	2	1	0	1	1	0	2	0	2	0	1	2
Other candida species	0	0	1	0	2	3	1	0	0	2	0	1
Other fungi	1	2	0	0	2	1	0	0	0	1	0	0
Fungi, total	3	3	1	1	5	4	3	0	2	3	1	3

Table 17. Cerebrospinal fluid culture findings in infants (under 12 months), 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Neisseria meningitidis	1	2	4	0	1	2	1	2	1	0	3	3
Staphylococcus epidermidis	3	3	3	3	3	2	1	2	2	2	1	3
Streptococcus pneumoniae	3	6	8	3	1	4	3	2	3	2	1	2
Staphylococcus aureus	0	3	2	1	0	1	2	2	1	0	3	1
Acinetobacter species	1	0	0	0	1	0	0	0	0	0	0	0
Bacillus	0	0	0	0	1	0	0	0	0	0	0	0
Bacteroides, other than fragilis group	0	0	0	0	0	1	0	0	0	0	0	0
Citrobacter species	0	0	0	0	0	1	0	0	1	0	0	0
Enterobacter species	0	0	1	0	0	0	0	0	0	0	0	0
Enterococcus faecalis	0	1	1	0	2	1	0	0	0	0	0	0
Enterococcus faecium	0	0	0	0	1	0	0	0	0	0	0	0
Escherichia coli	1	1	2	0	2	1	1	1	2	1	0	0
Haemophilus influenza	0	1	0	1	0	0	0	1	0	0	0	0
Klebsiella species	0	0	0	0	0	0	0	1	0	0	1	0
Mycobacterium, other than avium	0	0	0	0	0	0	0	0	1	0	0	0
Propionibacterium species	0	1	1	0	0	0	0	0	0	0	0	0
Serratia species	0	0	1	0	0	0	0	0	0	0	0	0
Staphylococcus, other coagulase-negative	4	1	2	1	0	0	4	1	0	0	2	0
Streptococcus agalactiae	5	1	10	7	7	6	3	6	8	2	3	0
Streptococcus pyogenes	0	0	0	0	0	0	0	1	0	0	0	0
Streptococcus viridans group	0	1	0	0	0	0	0	2	0	1	0	0
Other bacteria	2	1	1	0	0	0	0	1	0	0	0	1
Bacteria, total	20	22	36	16	19	19	15	22	19	8	14	10
Candida albicans	0	0	0	0	0	0	0	1	0	0	0	0
Fungi, total	0	0	0	0	0	0	0	1	0	0	0	0

Table 18. Cerebrospinal fluid culture findings in children (aged 1 to 14), 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Streptococcus pneumoniae	2	10	2	1	5	5	2	4	2	3	0	4
Neisseria meningitidis	7	4	4	5	7	5	3	2	3	4	2	3
Staphylococcus aureus	1	2	2	0	0	2	3	3	2	2	2	1
Staphylococcus, other coagulase-negative	3	2	2	2	0	0	0	1	0	0	0	1
Acinetobacter species	1	0	1	1	0	0	0	0	0	0	0	0
Bacteroides fragilis group	0	0	0	0	1	0	0	0	0	0	0	0
Citrobacter species	1	0	0	0	0	0	0	0	0	0	0	0
Corynebacterium species	0	0	0	0	0	0	2	0	1	0	0	0
Enterobacter species	0	0	1	0	0	0	0	1	0	0	1	0
Enterococcus faecalis	0	0	1	1	0	0	0	0	1	0	0	0
Enterococcus faecium	1	0	1	0	0	0	0	0	0	0	0	0
Escherichia coli	0	0	0	0	1	0	0	0	0	0	1	0
Haemophilus influenzae	0	4	0	0	0	0	0	0	0	1	0	0
Mycobacterium, other than avium	0	1	0	0	0	0	0	0	0	0	0	0
Peptostreptococcus and Peptococcus	0	0	0	0	1	0	0	0	0	0	0	0
Propionibacterium species	0	0	0	1	0	0	0	0	0	1	0	0
Staphylococcus epidermidis	7	1	4	2	0	1	5	2	1	2	1	0
Stenotrophomonas maltophilia	0	1	0	0	0	0	0	0	0	0	0	0
Streptococcus agalactiae	0	0	0	0	0	0	0	0	0	0	0	0
Streptococcus pyogenes	1	0	0	0	0	0	0	0	0	0	1	0
Streptococcus viridans group	0	1	1	0	2	0	0	0	0	0	0	0
Streptococcus, other beta-haemolytic	1	0	0	0	0	0	0	1	0	0	0	0
Other bacteria	5	0	0	5	1	0	6	3	1	4	2	2
Bacteria, total	30	26	19	18	18	13	21	17	11	17	10	11
Candida albicans	0	0	1	0	0	0	0	0	0	0	1	0
Fungi, total	0	0	1	0	0	0	0	0	0	0	1	0

BLOOD AND CEREBROSPINAL FLUID FINDINGS IN ADULTS

Blood culture findings in adults

The total number of blood culture findings in adults in 2013 was 11,658 (2012: 11,096). The number of blood culture findings in the over 65 age group continued to grow, as previously, being 7,614 (2012: 7153). 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 5% and fungi 2% of all blood culture positive findings among adults.

In the working-age population, the most common bacterial finding was *Escherichia coli*, constituting almost a quarter of all cases (Table 19). The next most common findings were *Staphylococcus aureus* (16%), *Streptococcus pneumoniae* (9%), coagulase-negative staphylococci (9 %), and *Klebsiella* species (5%).

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 20). The next most common findings were *S. aureus* (12%), coagulase-negative staphylococci (8%) and *Klebsiella* species (7 %).

Cerebrospinal fluid findings in adults

The total number of cerebrospinal fluid findings in adults in 2013 was 112 (2000–2012 average 141, variation 36–191). Patients over the age of 65 accounted for 39% of the cases (44 out of 112).

Coagulase-negative staphylococcus was reported in 34 per cent of cases involving working-age patients (Table 22). The most common actual pathogens were pneumococcus (19%) and *S. aureus* (16%). In patients aged 65 years or older, coagulase-negative staphylococcus accounted for 27% of the findings (Table 23). The most commonly reported actual pathogens were *S. aureus* (23%), pneumococcus (14%) and *Listeria monocytogenes* (9%).

Group A streptococcus

In 2013, the number of invasive infections of Group A streptococcus (*Streptococcus pyogenes*) decreased slightly in comparison with the previous year (2013: 191 and 2012: 216). The prevalent emm types of Group A streptococcus were the same as in previous years: emm1, emm28 and emm89. The appearance of the macrolide-resistant type emm33 in 2012 (5; 2%) is noteworthy, as is the increase during 2013 (13; 7%). In addition to the aforementioned, the share of emm12 has steadily remained elevated (5%). The previously common type emm84 was not detected at all in 2013. Although new emm types continuously emerge, the four most common emm types accounted for 72% of all cases in 2013 (Table 21).

Table 19. Blood culture findings in patients aged 15 to 64, 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Escherichia coli	580	645	707	780	797	837	871	885	930	935	942	951
Staphylococcus aureus	462	448	488	459	565	549	529	540	585	645	622	653
Streptococcus pneumoniae	333	406	386	377	348	353	480	441	413	393	362	356
Klebsiella species	134	121	159	184	145	159	198	187	207	164	216	220
Staphylococcus epidermidis	305	286	294	286	281	265	279	313	264	223	181	210
Streptococcus, other beta-haemolytic	78	80	101	96	127	117	113	113	131	139	119	156
Staphylococcus, other coagulase-negative	138	114	126	113	120	141	151	137	139	143	104	153
Streptococcus pyogenes	93	78	100	76	105	134	157	118	113	102	126	110
Streptococcus viridans group	105	126	141	141	130	118	140	144	150	139	88	106
Bacteroides fragilis group	61	59	67	83	85	82	109	68	110	109	103	102
Streptococcus milleri group	48	48	48	54	62	64	72	57	68	86	78	98
Streptococcus agalactiae	78	68	64	99	76	83	96	95	110	75	89	96
Pseudomonas aeruginosa	73	85	58	88	62	72	74	78	91	92	79	91
Enterobacter species	53	60	62	49	77	70	69	82	99	86	96	90
Bacillus	18	22	15	18	22	24	25	21	32	34	27	42
Fusobacterium species	15	21	32	31	19	31	31	27	37	31	48	41
Salmonella, other than Typhi	12	22	35	29	50	58	48	26	42	33	35	37
Serratia species	12	14	10	16	18	19	24	27	20	32	25	32
Citrobacter species	14	10	21	15	28	19	23	29	31	28	25	23
Peptostreptococcus and Peptococcus	22	23	15	21	18	11	12	27	15	30	18	22
Proteus mirabilis	15	11	15	12	18	14	14	18	26	17	24	22
Haemophilus influenzae	9	33	11	13	9	26	18	19	18	22	25	20
Morganella morganii	3	4	4	3	8	7	14	8	6	8	7	18
Capnocytophaga canimorsus	6	6	6	8	8	8	8	11	11	17	13	14
Clostridium, other or unidentified	28	14	17	22	20	15	19	20	22	19	16	14
Stenotrophomonas maltophilia	14	6	12	12	7	5	15	12	12	9	7	14
Acinetobacter species	13	10	16	16	10	21	13	18	14	21	14	11

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Listeria monocytogenes	9	12	7	10	10	9	8	9	15	7	17	11
Prevotella species	4	11	11	15	11	8	13	13	15	16	16	10
Propionibacterium species	8	11	6	9	7	5	3	9	6	9	7	9
Pseudomonas, other than aeruginosa	3	4	5	4	0	4	9	7	7	7	8	9
Veillonella species	2	3	1	6	3	5	3	7	5	13	6	9
Campylobacter species	7	10	13	5	3	8	7	11	10	4	6	8
Clostridium perfringens	6	9	6	16	11	12	10	16	16	8	11	8
Bacteroides, other than fragilis group	5	0	5	2	4	3	5	10	1	7	3	7
Mycobacterium avium	0	1	0	2	2	2	1	2	2	2	3	5
Neisseria meningitidis	20	18	18	16	20	21	9	13	14	17	12	5
Salmonella Typhi	1	3	4	3	3	4	1	3	9	3	1	5
Haemophilus, other than influenzae	4	1	5	6	3	3	3	0	2	3	9	4
Streptococcus bovis species	2	2	3	8	5	7	1	6	7	6	6	4
Mycobacterium, other or unidentified	1	4	0	1	2	3	1	0	0	2	1	3
Proteus vulgaris	0	3	4	3	7	3	2	3	2	2	3	2
Hafnia alvei	1	5	4	3	0	1	3	6	2	2	2	1
Yersinia pseudotuberculosis	2	1	1	0	0	0	1	0	0	0	1	1
Enterococcus faecalis	99	84	80	100	83	105	83	107	86	97	78	0
Enterococcus faecium	53	51	45	66	69	81	91	89	91	108	64	0
Enterococcus, other or unidentified	14	10	10	11	6	4	7	13	13	12	16	0
Yersinia enterocolitica	0	0	0	1	0	0	0	1	1	0	0	0
Other bacteria	92	84	89	93	97	84	103	99	90	93	104	131
Bacteria, total	3055	3147	3327	3481	3561	3674	3966	3945	4090	4050	3863	3934
Candida albicans	29	43	45	42	54	55	55	55	57	74	56	64
Other candida species	23	35	24	22	22	25	42	28	37	30	31	42
Other fungi	2	1	2	1	2	2	4	5	2	5	2	4
Fungi, total	54	79	71	65	78	82	101	88	96	109	89	110

Table 20. Blood culture findings in patients aged 65 or over, 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Escherichia coli	1213	1314	1466	1624	1706	1760	1890	2056	2233	2481	2474	2881
Staphylococcus aureus	452	467	486	484	602	570	675	692	731	783	800	883
Klebsiella species	230	253	341	339	326	338	420	462	468	473	537	559
Staphylococcus epidermidis	228	231	254	284	265	275	299	270	325	316	299	344
Streptococcus, other beta-haemolytic	100	123	135	140	174	171	177	222	258	267	294	322
Streptococcus pneumoniae	200	241	239	229	270	294	326	294	303	296	343	319
Staphylococcus, other coagulase-negative	134	112	114	116	129	139	165	155	143	156	170	251
Pseudomonas aeruginosa	148	148	139	151	154	188	191	184	218	196	249	230
Bacteroides fragilis group	96	118	120	135	119	135	146	164	178	203	183	203
Enterobacter species	87	97	92	115	95	105	131	128	156	157	172	189
Streptococcus viridans group	83	103	103	106	110	115	140	135	132	138	89	141
Streptococcus agalactiae	49	62	76	84	81	77	94	104	126	113	117	129
Proteus mirabilis	57	62	80	57	68	93	99	102	106	98	130	119
Citrobacter species	40	44	43	42	42	35	65	59	76	59	95	100
Streptococcus milleri group	28	43	45	50	67	54	53	62	59	58	65	92
Serratia species	15	28	18	33	27	33	50	37	59	56	65	81
Streptococcus pyogenes	46	28	33	34	48	58	50	63	50	50	75	72
Listeria monocytogenes	11	19	18	20	26	26	26	20	44	31	36	45
Clostridium perfringens	26	27	32	29	36	39	34	49	40	51	56	35
Peptostreptococcus and Peptococcus	14	20	13	17	22	25	14	29	36	26	24	32
Morganella morganii	13	10	14	21	14	26	11	18	29	30	16	30
Streptococcus bovis group	7	9	20	12	17	17	15	25	12	12	17	26
Acinetobacter species	17	8	13	10	18	11	12	16	16	17	19	21
Haemophilus influenzae	15	32	13	28	21	25	21	22	19	37	51	20
Fusobacterium species	16	7	13	10	9	15	10	8	17	14	19	18
Bacillus	11	10	10	10	17	9	11	12	7	14	7	17
Clostridium, other or unidentified	23	18	25	21	22	31	18	27	35	24	26	17

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Proteus vulgaris	7	8	7	9	9	9	4	4	8	8	12	14
Bacteroides, other than fragilis group	3	5	8	4	3	5	8	13	8	8	16	12
Capnocytophaga canimorsus	1	1	1	1	4	2	3	2	2	6	7	12
Pseudomonas, other than aeruginosa	6	6	3	7	9	11	10	11	10	8	11	12
Stenotrophomonas maltophilia	3	6	10	6	10	8	3	6	7	4	8	12
Prevotella species	11	4	11	10	10	8	11	15	13	14	7	11
Veillonella species	0	1	1	7	2	6	9	5	4	6	5	10
Salmonella, other than Typhi	7	5	6	14	11	8	19	6	8	7	13	9
Propionibacterium species	15	4	8	13	9	4	5	9	10	13	6	7
Haemophilus, other than influenzae	2	1	3	2	2	1	1	1	1	0	3	6
Hafnia alvei	1	1	4	4	3	6	8	7	7	1	8	6
Enterococcus, other or unidentified	18	19	16	17	19	15	24	20	24	33	26	5
Campylobacter species	3	1	5	3	5	3	5	6	3	1	4	4
Neisseria meningitidis	4	4	3	2	5	2	6	6	6	6	5	4
Mycobacterium, other or unidentified	0	2	3	0	5	1	3	0	5	1	1	1
Enterococcus faecalis	149	146	192	183	202	220	217	222	229	275	216	0
Enterococcus faecium	48	76	97	74	108	132	126	175	180	198	135	0
Mycobacterium avium	1	0	0	1	0	0	1	0	0	0	0	0
Salmonella Typhi	0	1	0	1	0	0	0	0	0	0	0	0
Yersinia enterocolitica	1	3	1	1	1	1	0	1	1	0	3	0
Yersinia pseudotuberculosis	1	1	2	2	1	1	0	3	1	0	1	0
Other bacteria	68	87	96	96	96	82	124	123	121	143	140	176
Bacteria, total	3708	4016	4432	4658	4999	5189	5730	6050	6524	6888	7055	7477
Candida albicans	39	63	51	39	54	56	66	49	93	65	70	77
Other candida species	31	46	27	25	22	27	25	42	33	44	39	59
Other fungi	0	3	0	3	0	0	2	0	0	4	0	1
Fungi, total	70	112	78	67	76	83	93	91	126	113	109	137

Table 21. Group A Streptococcus blood findings by emm-type, 2006–2013 (no. of cases and %).

Cases notified to NIDR	Stains examined	emm1	emm28	emm84	emm89	emm33	Other	NT
2006	163	25 (15 %)	33 (20 %)	24 (15 %)	11 (7 %)	0 (0 %)	59 (36 %)	11 (7 %)
2007	205	58 (28 %)	26 (13 %)	32 (16 %)	12 (6 %)	0 (0 %)	72 (35 %)	5 (2 %)
2008	225	52 (23 %)	47 (21 %)	9 (4 %)	10 (4 %)	0 (0 %)	102 (45 %)	5 (2 %)
2009	191	25 (13 %)	56 (29 %)	4 (2 %)	29 (15 %)	0 (0 %)	74 (39 %)	3 (2 %)
2010	167	22 (13 %)	37 (22 %)	4 (2 %)	26 (16 %)	0 (0 %)	77 (46 %)	1 (<1 %)
2011	163	25 (15 %)	37 (23 %)	4 (2 %)	30 (18 %)	0 (0 %)	66 (40 %)	1 (<1 %)
2012	210	23 (11 %)	66 (31 %)	1 (<1 %)	58 (28 %)	5 (2 %)	52 (25 %)	5 (2 %)
2013	176	13 (7 %)	58 (33 %)	0 (0 %)	43 (24 %)	13 (7 %)	49 (28 %)	0 (0 %)

Table 22. Cerebrospinal fluid culture findings in patients aged 15 to 64, 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Streptococcus pneumoniae	19	26	21	16	17	14	26	19	14	12	18	13
Staphylococcus epidermidis	27	21	24	34	32	17	27	18	11	10	21	12
Staphylococcus aureus	6	10	17	10	9	16	13	13	12	20	15	11
Staphylococcus, other coagulase-negative	12	6	16	14	12	7	14	10	8	6	7	11
Propionibacterium species	6	6	11	5	5	5	4	4	7	4	5	7
Enterobacter species	1	0	3	5	2	2	9	3	1	2	4	2
Haemophilus influenzae	2	0	1	0	0	0	3	1	0	2	1	2
Listeria monocytogenes	0	2	1	0	2	1	1	2	1	1	1	2
Campylobacter species	0	0	0	1	0	0	0	0	0	0	0	1
Corynebacterium species	0	1	1	2	1	1	0	1	0	0	1	1
Escherichia coli	3	0	0	7	4	3	3	4	1	1	2	1
Klebsiella species	0	0	0	0	0	0	4	2	1	2	0	1
Neisseria meningitidis	19	15	11	15	20	16	4	9	6	7	6	1
Pseudomonas aeruginosa	5	4	2	4	6	3	4	5	3	1	4	1
Streptococcus agalactiae	1	0	2	0	1	5	2	0	2	0	1	1
Acinetobacter species	2	1	1	3	3	5	2	3	0	2	2	0
Bacillus	5	0	0	3	6	4	3	0	0	0	2	0
Capnocytophaga canimorsus	0	0	0	0	0	0	0	1	0	0	1	0
Citrobacter species	0	1	1	2	0	1	0	0	1	0	1	0
Enterococcus faecalis	2	3	5	3	4	5	4	3	4	3	3	0
Enterococcus faecium	1	0	2	1	0	1	0	1	0	2	2	0
Enterococcus, other or unidentified	1	0	0	0	1	1	1	0	0	1	0	0
Haemophilus, other than influenzae	0	0	0	0	0	1	0	0	0	2	0	0
Morganella morganii	1	0	0	0	0	0	0	0	0	0	0	0
Mycobacterium, other than avium	2	1	0	0	0	1	2	0	0	0	2	0
Peptostreptococcus and Peptococcus	0	2	0	0	0	0	0	1	0	0	0	0

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Prevotella species	1	0	0	0	0	0	0	0	0	0	0	0
Proteus mirabilis	0	0	0	0	0	0	0	0	0	1	0	0
Pseudomonas, other than aeruginosa	0	1	0	0	1	1	1	1	0	1	0	0
Salmonella, other than Typhi	0	1	0	0	0	0	2	0	0	1	0	0
Serratia group	0	2	1	1	0	3	0	0	0	1	0	0
Stenotrophomonas maltophilia	0	0	1	0	0	1	0	0	0	1	0	0
Streptococcus bovis group	0	0	0	0	0	0	0	0	1	0	0	0
Streptococcus milleri group	0	0	0	0	0	0	1	0	0	0	0	0
Streptococcus pyogenes	1	1	0	0	1	0	2	2	1	1	0	0
Streptococcus viridans group	6	2	1	4	7	2	1	2	2	4	1	0
Streptococcus, other beta-haemolytic	2	0	1	1	0	0	1	2	1	2	0	0
Other bacteria	6	3	3	5	10	7	5	7	2	6	3	0
Bacteria, total	131	109	126	136	144	123	139	114	79	96	103	67
Candida albicans	1	1	2	1	0	1	0	0	0	0	1	0
Other candida species	1	0	3	1	3	4	1	0	1	0	2	1
Other fungi	0	0	0	0	0	1	0	0	0	0	0	0
Fungi, total	2	1	5	2	3	6	1	0	1	0	3	1

Table 23. Cerebrospinal fluid culture findings in patients aged 65 or over, 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Staphylococcus aureus	2	7	7	5	3	2	3	6	5	5	2	10
Staphylococcus epidermidis	7	5	6	10	9	12	10	6	2	4	7	7
Streptococcus pneumoniae	4	5	4	8	10	4	7	10	6	7	4	6
Staphylococcus, other coagulase-negative	5	4	5	5	3	2	3	3	3	1	3	5
Listeria monocytogenes	2	4	2	4	3	2	2	2	6	4	4	4
Propionibacterium species	4	0	1	0	2	0	2	2	1	1	2	3
Pseudomonas aeruginosa	0	0	1	0	1	0	2	0	0	0	1	2
Citrobacter species	0	0	0	0	0	0	0	0	0	1	0	1
Enterobacter species	2	0	1	0	0	1	0	0	1	1	1	1
Escherichia coli	1	2	2	1	1	0	1	1	1	2	1	1
Neisseria meningitidis	0	1	1	2	1	0	1	0	2	0	1	1
Streptococcus agalactiae	0	1	0	0	0	0	0	1	1	0	0	1
Streptococcus, other beta-haemolytic	0	2	0	1	0	0	0	1	0	0	0	1
Acinetobacter species	2	1	0	0	1	1	0	0	0	0	0	0
Bacillus	3	0	0	0	0	0	1	0	0	2	1	0
Bacteroides fragilis group	0	0	0	0	0	0	0	1	0	0	0	0
Corynebacterium species	0	1	0	0	0	0	0	0	1	0	0	0
Enterococcus faecalis	2	3	0	2	2	3	0	1	0	0	1	0
Enterococcus faecium	0	1	0	0	0	0	0	1	0	0	1	0
Enterococcus, other or unidentified	1	0	0	0	0	0	0	0	1	0	0	0
Haemophilus influenzae	0	0	0	1	2	2	1	1	0	1	0	0
Klebsiella species	0	0	0	0	0	0	1	1	0	0	0	0
Mycobacterium avium	0	0	0	1	0	0	0	0	0	0	0	0
Mycobacterium, other than avium	1	4	1	3	0	0	1	1	0	1	0	0
Peptostreptococcus and Peptococcus	0	1	0	0	0	0	0	0	0	0	1	0
Proteus mirabilis	0	0	0	0	0	0	1	1	0	0	0	0
Proteus vulgaris	0	0	0	1	0	0	0	0	0	0	0	0

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Pseudomonas, other than aeruginosa	0	0	1	0	0	0	0	0	0	0	0	0
Serratia species	0	0	1	0	0	0	0	0	0	0	0	0
Stenotrophomonas maltophilia	0	0	1	0	0	0	0	0	0	0	0	0
Streptococcus bovis group	0	0	0	0	0	0	0	1	0	0	0	0
Streptococcus milleri group	0	0	0	0	0	0	0	1	0	0	0	0
Streptococcus pyogenes	2	0	0	0	0	0	0	0	0	0	0	0
Streptococcus viridans group	1	0	1	0	1	1	0	3	1	0	0	0
Other bacteria	3	2	1	2	3	2	1	1	5	3	0	1
Bacteria, total	42	44	36	46	42	32	37	45	36	33	30	44
Candida albicans	0	0	0	1	0	0	1	0	0	0	1	0
Other candida species	2	0	1	0	2	0	0	2	0	2	0	0
Fungi, total	2	0	1	1	2	0	1	2	0	2	1	0

Table 24. Blood culture findings in all age groups, 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Escherichia coli	1846	2011	2225	2455	2563	2651	2813	2991	3223	3475	3455	3877
Staphylococcus aureus	996	983	1064	1016	1241	1187	1267	1290	1383	1491	1500	1602
Klebsiella species	377	386	514	542	482	509	631	660	682	646	765	786
Streptococcus pneumoniae	642	766	741	733	744	783	919	852	831	774	748	718
Staphylococcus epidermidis	649	608	683	709	686	665	687	678	697	644	547	626
Streptococcus, other beta-haemolytic	179	207	240	238	306	289	290	340	393	407	415	478
Staphylococcus, other coagulase-negative	321	262	285	273	298	337	362	351	335	345	311	436
Pseudomonas aeruginosa	226	240	204	245	219	262	268	265	318	293	331	325
Bacteroides fragilis group	158	177	189	221	204	218	256	233	289	314	286	305
Enterobacter species	147	169	162	170	186	185	210	216	260	256	274	282
Streptococcus viridans group	209	255	277	283	274	265	309	313	336	308	194	268
Streptococcus agalactiae	173	169	186	256	212	213	240	250	290	230	242	256
Streptococcus pyogenes	150	119	140	110	162	208	220	196	171	168	216	191
Streptococcus milleri group	78	91	93	107	132	118	127	121	129	145	144	190
Proteus mirabilis	72	73	97	69	87	109	113	120	132	115	154	141
Citrobacter species	56	55	64	59	71	56	90	90	109	87	121	123
Serratia group	33	44	32	50	49	56	78	65	82	92	90	115
Bacillus	34	39	29	37	46	37	46	38	43	51	40	65
Fusobacterium species	34	28	46	43	31	51	46	36	55	46	68	60
Listeria monocytogenes	20	32	25	30	38	36	34	30	61	38	54	58
Peptostreptococcus and Peptococcus	36	43	28	38	40	36	26	56	52	58	43	54
Salmonella, other than Typhi	21	28	42	44	63	71	69	33	56	43	51	51
Morganella morganii	16	14	18	24	22	33	25	26	35	38	23	48
Haemophilus influenzae	25	75	25	44	32	54	44	46	40	64	80	44
Clostridium perfringens	33	37	38	46	48	53	44	66	57	59	67	43
Acinetobacter species	42	23	31	31	32	36	28	39	34	40	35	37
Clostridium, other or unidentified	53	34	43	46	46	50	39	49	60	44	46	31

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Streptococcus bovis group	10	12	24	21	23	24	16	33	19	18	23	30
Stenotrophomonas maltophilia	18	14	25	19	18	18	22	22	23	13	16	27
Capnocytophaga canimorsus	7	7	7	9	12	10	11	13	13	23	20	26
Prevotella species	15	15	23	25	21	16	25	28	28	30	23	21
Pseudomonas, other than aeruginosa	10	11	8	12	9	16	19	21	17	15	19	21
Bacteroides, other than fragilis group	8	5	13	6	7	8	13	23	9	15	19	19
Veillonella species	2	4	2	13	7	11	12	12	10	19	11	19
Propionibacterium species	24	16	14	22	16	10	8	18	16	23	15	17
Neisseria meningitidis	34	30	28	28	32	29	22	24	30	26	21	16
Proteus vulgaris	7	11	11	12	16	12	6	7	10	10	15	16
Campylobacter species	10	11	18	8	8	11	12	17	13	5	10	12
Haemophilus, other than influenzae	6	3	8	9	6	4	5	1	3	4	13	11
Hafnia alvei	2	6	8	7	3	7	11	13	9	3	10	7
Salmonella Typhi	2	5	5	6	3	6	1	3	9	5	1	6
Enterococcus, other or unidentified	32	31	29	28	27	21	34	35	38	45	43	5
Mycobacterium avium	1	1	0	3	2	2	2	2	2	2	3	5
Mycobacterium, other or unidentified	1	6	3	1	7	4	4	0	5	4	2	4
Yersinia pseudotuberculosis	3	3	3	2	1	1	1	3	1	0	2	1
Enterococcus faecalis	263	243	283	302	309	339	311	343	341	387	310	0
Enterococcus faecium	107	130	147	144	183	217	220	273	280	307	200	0
Yersinia enterocolitica	1	3	1	2	1	1	0	2	2	0	3	0
Other bacteria	188	191	211	215	212	191	244	237	239	256	261	320
Bacteria, total	7377	7726	8392	8813	9237	9526	10280	10580	11270	11481	11340	11793
Candida albicans	80	109	99	86	113	113	126	105	154	140	128	144
Other candida species	62	83	52	48	46	56	69	70	70	77	72	102
Other fungi	3	6	2	4	4	4	6	5	2	10	2	5
Fungi, total	145	198	153	138	163	173	201	180	226	227	202	251

Table 25. Cerebrospinal fluid culture findings in all age groups, 2002–2013 (no. of cases).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Streptococcus pneumoniae	28	47	35	28	33	27	38	35	25	24	23	25
Staphylococcus aureus	9	22	28	16	12	21	21	24	20	27	22	23
Staphylococcus epidermidis	44	30	37	49	44	32	43	28	16	18	30	22
Staphylococcus, other coagulase-negative	24	13	25	22	15	9	21	15	11	7	12	17
Propionibacterium species	10	7	13	6	7	5	6	6	8	6	7	10
Neisseria meningitidis	27	22	20	22	29	23	9	13	12	11	12	8
Listeria monocytogenes	2	6	3	4	5	3	3	4	7	5	5	6
Enterobacter species	3	0	6	5	2	3	9	4	2	3	6	3
Pseudomonas aeruginosa	5	4	3	4	7	3	6	5	3	1	5	3
Escherichia coli	5	3	4	8	8	4	5	6	4	4	4	2
Haemophilus influenzae	2	5	1	2	2	2	4	3	0	4	1	2
Streptococcus agalactiae	6	2	12	7	8	11	5	7	11	2	4	2
Campylobacter species	0	0	0	1	0	0	0	0	0	0	0	1
Citrobacter species	1	1	1	2	0	2	0	0	2	1	1	1
Corynebacterium species	0	2	1	2	1	1	2	1	2	0	1	1
Klebsiella species	0	0	0	0	0	0	5	4	1	2	1	1
Streptococcus, other beta-haemolytic	3	2	1	2	0	0	1	4	1	2	0	1
Acinetobacter species	6	2	2	4	5	6	2	3	0	2	2	0
Bacillus	8	0	0	3	7	4	4	0	0	2	3	0
Bacteroides fragilis group	0	0	0	0	1	0	0	1	0	0	0	0
Bacteroides, other than fragilis species	0	0	0	0	0	1	0	0	0	0	0	0
Capnocytophaga canimorsus	0	0	0	0	0	0	0	1	0	0	1	0
Enterococcus faecalis	4	7	7	6	8	9	4	4	5	3	4	0
Enterococcus faecium	2	1	3	1	1	1	0	2	0	2	3	0
Enterococcus, other or unidentified	2	0	0	0	1	1	1	0	1	1	0	0
Haemophilus,other than influenzae	0	0	0	0	0	1	0	0	0	2	0	0
Morganella morganii	1	0	0	0	0	0	0	0	0	0	0	0

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Mycobacterium avium	0	0	0	1	0	0	0	0	0	0	0	0
Mycobacterium, other than avium	3	6	1	3	0	1	3	1	1	1	2	0
Peptostreptococcus and Peptococcus	0	3	0	0	1	0	0	1	0	0	1	0
Prevotella species	1	0	0	0	0	0	0	0	0	0	0	0
Proteus mirabilis	0	0	0	0	0	0	1	1	0	1	0	0
Proteus vulgaris	0	0	0	1	0	0	0	0	0	0	0	0
Pseudomonas, other than aeruginosa	0	1	1	0	1	1	1	1	0	1	0	0
Salmonella, other than Typhi	0	1	0	0	0	0	2	0	0	1	0	0
Serratia species	0	2	3	1	0	3	0	0	0	1	0	0
Stenotrophomonas maltophilia	0	1	2	0	0	1	0	0	0	1	0	0
Streptococcus bovis group	0	0	0	0	0	0	0	1	1	0	0	0
Streptococcus milleri group	0	0	0	0	0	0	1	1	0	0	0	0
Streptococcus pyogenes	4	1	0	0	1	0	2	3	1	1	1	0
Streptococcus viridans group	7	4	3	4	10	3	1	7	3	5	1	0
Other bacteria	16	6	5	12	14	9	12	12	8	13	5	4
Bacteria, total	223	201	217	216	223	187	212	198	145	154	157	132
Candida albicans	1	1	3	2	0	1	1	1	0	0	3	0
Other candida species	3	0	4	1	5	4	1	2	1	2	2	1
Other fungi	0	0	0	0	0	1	0	0	0	0	0	0
Fungi, total	4	1	7	3	5	6	2	3	1	2	5	1

Authors

Respiratory infections

Adenovirus
Niina Ikonen, Outi Lyytikäinen (THL)

Influenza A and B
Niina Ikonen, Outi Lyytikäinen, Hanna Nohynek (THL)

Parainfluenza
Niina Ikonen, Outi Lyytikäinen (THL)

Rhinovirus
Carita Savolainen-Kopra, Outi Lyytikäinen (THL)

RSV
Niina Ikonen, Outi Lyytikäinen (THL)

Whooping cough
Suvi Timonen, Qiushui He, Hanna Nohynek (THL)

Chlamydia pneumoniae
Mirja Puolakkainen (University of Helsinki)

Legionella
Suvi Timonen, Jaana Kusnetsov, Silja Mentula, Sari Jaakola, Outi Lyytikäinen (THL)

Mycoplasma pneumoniae
Mirja Puolakkainen (University of Helsinki)

Gastrointestinal infections

Food-borne epidemics
Ruska Rimhanen-Finne, Saara Salmenlinna, Susanna Lukinmaa-Åberg, Aino Kyyhkynen, Anja Siitonen (THL)

Clostridium difficile
Outi Lyytikäinen, Silja Mentula (THL)

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

Campylobacter
Markku Kuusi, Susanna Lukinmaa-Åberg (THL)

Listeria
Ruska Rimhanen-Finne, Susanna Lukinmaa-Åberg (THL)

Salmonella
Ruska Rimhanen-Finne, Saara Salmenlinna, Anja Siitonen, Hanna Nohynek (THL)

Shigella
Markku Kuusi, Anja Siitonen (THL)

Yersinia
Elisa Huovinen, Anja Siitonen (THL)

Norovirus
Merja Roivainen, Markku Kuusi, Haider Al-Hello (THL),
Leena Maunula (University of Helsinki)

Rotavirus
Suvi Timonen, Merja Roivainen, Haider Al-Hello, Tuija Leino (THL),
Leena Maunula (University of Helsinki)

Hepatitides

Hepatitis A
Markku Kuusi, Mia Kontio, Tuija Leino (THL)

Hepatitis B
Markku Kuusi, Henrikki Brummer-Korvenkontio, Kirsi Liitsola, Tuija Leino (THL)

Hepatitis C
Elisa Huovinen, Maarit Sillanpää, Henrikki Brummer-Korvenkontio, Kirsi Liitsola (THL)

Sexually transmitted diseases

Chlamydia
Eija Hiltunen-Back (HUS)

Gonorrhoea
Eija Hiltunen-Back (HUS),
Jari Jalava (THL)

Syphilis
Eija Hiltunen-Back (HUS)

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

Antimicrobial resistance

MRSA
Outi Lyytikäinen, Laura Lindholm, Jaana Vuopio (THL)

VRE
Outi Lyytikäinen, Laura Lindholm, Jaana Vuopio (THL)

ESBL
Outi Lyytikäinen, Jari Jalava, Monica Österblad (THL)

Tuberculosis

Tuberculosis
Hanna Soini, Outi Lyytikäinen (THL),
Tuula Vasankari (Filha)

Other infections

Invasive pneumococcal disease
Outi Lyytikäinen, Jari Jalava, Maija Toropainen, Lotta Siira, Arto Palmu, Pekka Nuorti (THL)

Haemophilus
Suvi Timonen, Maija Toropainen, Tuija Leino, (THL)

Meningococcus
Suvi Timonen, Maija Toropainen, Anni Vainio, Hanna Nohynek (THL)

MMR diseases (measles, mumps, rubella)
Suvi Timonen, Mia Kontio, Tuija Leino (THL)

Varicella virus
Suvi Timonen, Tuija Leino (THL)

Borrelia
Suvi Timonen, Outi Lyytikäinen (THL)

Tick-borne encephalitis (TBE)
Suvi Timonen, Tuija Leino, Pirjo Turtiainen (THL),
Olli Vapalahti (University of Helsinki)

Puumala virus
Suvi Timonen (THL),
Olli Vapalahti (University of Helsinki)

Pogosta disease
Suvi Timonen (THL),
Satu Kurkela (University of Helsinki)

Tularemia
Heidi Rossow (THL)

Rabies
Suvi Timonen, Ruska Rimhanen-Finne (THL)

Malaria
Heli Siikamäki (HUS)

Dengue fever and other travel-related infections
Eeva Pekkanen (THL)

Blood and cerebrospinal fluid findings in children
Suvi Timonen, Outi Lyytikäinen, Arto Palmu (THL)

Blood and cerebrospinal fluid findings in adults
Suvi Timonen, Outi Lyytikäinen (THL)

Group A streptococcus
Laura Lindholm, Jaana Vuopio (THL)