Infectious Diseases in Finland

2006

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INFECTIOUS DISEASES IN FINLAND 2006

Editors: Eija Kela, Outi Lyytikäinen and Petri Ruutu

In addition to commentary, the report includes figures and tables that are not employed in our regular reporting. Distributions by gender, age and region are available on our website. The figures for some of the diseases in the National Infectious Diseases Register will still be updates after the figures have been published in print. Up-to-date figures are available at http://www3.ktl.fi/.

Guidelines and recommendations on infectious diseases are available on our website at http://www.ktl.fi/portal/suomi/julkaisut.

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1 INTRODUCTION

Year 2006 was characterised by enhanced preparedness for a pandemic, as outbreaks of the avian influenza subtype A H5N1 in wild and domestic birds were becoming geographically more widespread. The nature of the global pandemic threat did not change from previous years, as the virus was still very poorly transmissible to humans. No human transmissions were diagnosed in Europe despite outbreaks early in 2006 in most European countries, almost solely in wild birds. The repeated, extensive international biothreats early in the 2000s (intentionally-spread anthrax as well as SARS and H5N1 influenza) created the need to enhance the preparedness to control sudden, extensive biothreats. These efforts also generally reinforce the co-operation mechanisms and resources for infection control.

The European Center for Disease Control (ECDC), established in Stockholm in 2005, was very actively engaged in the development of expert recommendations for pandemic preparedness. It coordinated the work of national surveillance and control organisations at various occasions involving international epidemics or threats. ECDC initiated the evaluation of the infectious diseases surveillance system that covered the entire EU and was based on disease-specific networks. Based on the evaluation, the system will be reorganised in 2007–2008.

General epidemiological situation in 2006

Among respiratory infections, the annual influenza A epidemic had an exceptionally late start and continued into June. The number of laboratory-confirmed infections remained low, like the year before. The number of RSV notifications was the lowest since 1999. This is partly explained by the peak of the winter epidemic occurring right at the end of the previous year. The number of whooping cough cases was low, like in 2005, which may have resulted from the change in whooping cough vaccinations in 2003–2005, but it could also be due to the cyclical variation of the disease. About a third of the diagnosed legionella infections were associated with travel, with one case late in the year belonging to the Scandinavian cluster from Phuket, Thailand, that gained a lot of publicity.

As regards intestinal infections, salmonella cases continued to increase, but the number of infections acquired in Finland remained the same. The number of campylobacter infections, mainly acquired during travel, fell clearly from its previous level. The number of rotavirus cases was higher than ever in the history of the National Infectious Diseases Register. Extensive outbreaks were caused by a new norovirus subtype in institutional environments or by food transmission in summer and throughout autumn, and by *Yersinia pseudotuberculosis* transmitted via fresh root vegetables.

The hepatitis situation continued to develop favourably: the number of both hepatitis A and acute hepatitis B infections remained record-low, reflecting the efficiency of the preventive measures, ie. vaccination of risk groups and reducing injecting drug abuse. The number of new hepatitis C cases, normally associated with injecting drug use, fell, but the lack of laboratory diagnostics for acute infections complicates the interpretation of the trend.

The most alarming change in the epidemiological situation was the 40 per cent rise in the number of HIV cases from the previous, relatively stable situation, to a record level in the surveillance history of the National Infectious Diseases Register. This is due to an increase in sexually transmitted infections. The increase of sexually transmitted HIV cases and the record-high number of chlamydia cases in the surveillance history of the National Infectious Diseases Register point out the need for more efficient prevention of sexually transmitted diseases. The programme launched recently by the Ministry of Social Affairs and Health to promote sexual and reproductive health, will hopefully help to achieve more efficient prevention.

For the first time, the number of tuberculosis cases fell below 300. This proved that the slight rise in the year before was just a random disturbance in the favourable development that has continued for a long time. The antimicrobial susceptibility of the tuberculosis strains was still good. The new national tuberculosis programme 2006 supports treatment and control measures to ensure continuous favourable development. During the year, BCG vaccination of all newborn babies was discontinued and only those belonging to a risk group are vaccinated. Therefore, careful surveillance of tuberculosis in children is particularly important.

It is very alarming that the proportion of pneumococcal strains with reduced susceptibility to penicillin has clearly increased in strains cultured from blood or cerebrospinal fluid. The proportion of macrolide-resistant strains is also remarkable and on the rise.

Even though the number of Tick-born encephalitis (TBE) cases remained the same, the infection was more often than before acquired at the coast or on the continent, not in the traditional TBE region, Åland. In 2006, Åland initiated a TBE vaccination programme covering all local residents over 7 years of age. A significant cluster was identified in the Lappeenranta region. It is very likely that the source of infection was local.

Annually, some 10,000 infections are diagnosed in Finland where the causing bacterium can be cultured from blood or cerebrospinal fluid. The total number of findings in adults has increased continuously. In 2006, an increase could be seen particularly in group A betahaemolytic streptococci (*Streptococcus pyogenes*) in working-age adults. A record number of pneumococcal infections verified by blood culture were diagnosed in the elderly age group.

Helsinki 14 April 2007

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2 RESPIRATORY INFECTIONS

Influenza A

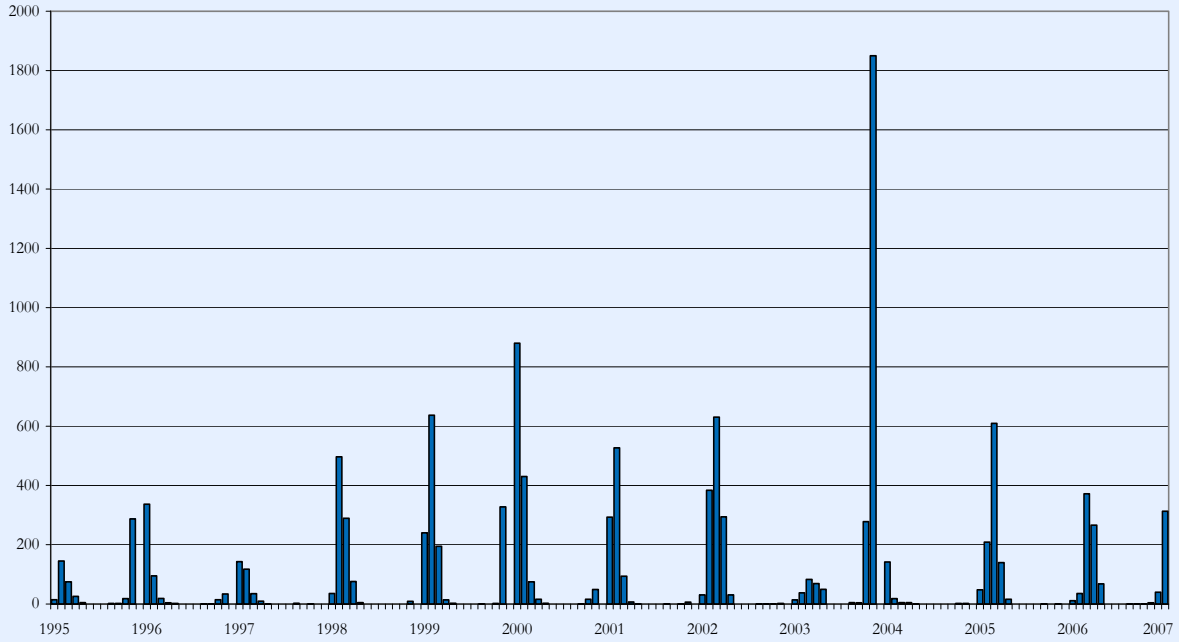
The epidemic was caused by subtype H3N2 viruses, which have typically caused clinically difficult infections in the youngest children and in over 65-year-olds. This was reflected clearly in the influenza A findings recorded in the National Infectious Diseases Register; 20 per cent were in the age group of under-5-year-olds and 18 per cent in over-65-year-olds. Once again, the epidemic had a late start. It peaked in March–April 2006, even later than the year before. As many as 45 per cent of the influenza A findings in the first half of the year were diagnosed in April–June. Identical to the epidemic season 2004–2005, the number of findings recorded in the Register was less than half of the number of findings during the exceptionally early epidemic in the season 2003–2004. The virological diagnostics used to identify the infections has hardly declined, and so the decreasing number of findings reflects less extensive epidemics. There are molecular epidemiology factors that explain the reduced size and later arrival of the epidemics.

The early arrival and great force of the 2003–2004 epidemic are explained by new Fujian/411/02 type viruses. As summer cut short the epidemic that arrived in spring 2003 and remained limited in size, the population's immunity level was still low in autumn 2003. After the season 2003–2004, the antigenic and genetic variation of H3N2 viruses has been faltering. Several slightly deviating virus lineages have emerged, but no clearly different form of the virus has appeared that could efficiently overcome protective immunity. The diversity of weak variants in winter 2006 was represented in Finland, for example, by the California/7/2004 and Wisconsin/67/2005 type variants. The former was the H3N2 virus in the autumn 2005 influenza vaccine and the latter in the autumn 2006 vaccine. Considering the diversity, the vaccination for the winter 2006 epidemic was constructed correctly with regard to the H3N2 viruses. Reduced infectivity of the virus may be another reason for the limited size of H3N2 epidemics and their delayed spreading. In recent years, viruses isolated in Finland have contained more changes than before in their adhesion proteins in the region the virus uses to attach itself to the surface of the host cell. While such changes may help the virus to overcome the population's protective immunity, they may also reduce its infectivity. It has become more difficult to isolate H3N2 viruses from patient samples in cell cultures, which suggests attenuation.

In the latter half of 2006, influenza A findings were recorded in the National Infectious Diseases Register at a steady rate of one case per month, which already in autumn implied that transmission chains had broken in summer and, considering the nature of antigenic variation, that in 2006–2007 the onset of the epidemic might once again be delayed until after New Year.

Influenza A subtype H1N1 viruses, commonly considered characteristic for children and young adults, were diagnosed at the National Public Health Institute only in nine patients (9 months – 46 years), all in late winter or early spring and in different parts of the country. Antigenically, the viruses corresponded to the New Caledonia/20/99 variant, which has circulated in the world for a long time and last caused a nationwide epidemic in Finland in winter 2000–2001. Some individual findings were made also in winters 2001–2002, 2002–2003 and 2004–2005 (Figure 1).

Figure 1. Influenza A cases by month 1995-2006. The total number of cases are provided by epidemic season (September-May, year 2007 January-February)



Influenza B

In 2006, the influenza B epidemic peaked in March–April, like the A epidemic. The age distribution of the cases notified to the National Infectious Diseases Register was different from that of the influenza A epidemic in the age group over-64-year-olds (only 1.4% of findings), as expected. After June, no influenza B cases were notified to the National Infectious Diseases Register. In long-term surveillance, B epidemics have broken out later than A epidemics. The probable reason is the lesser variation rate of the virus; the population's protective immunity has controlled B epidemics more efficiently than A epidemics. The number of cases in the Register suggests a less extensive B epidemic than in winter 2005, as well as a less extensive B epidemic compared with the A epidemic in winter 2006. In Europe, in the light of viral findings, the proportions of A and B epidemics varied considerably between countries. Based on findings in civilians, in Finland the B epidemic was less extensive than the A epidemic. In garrisons the situation was the contrast: 65 per cent of virologically con-

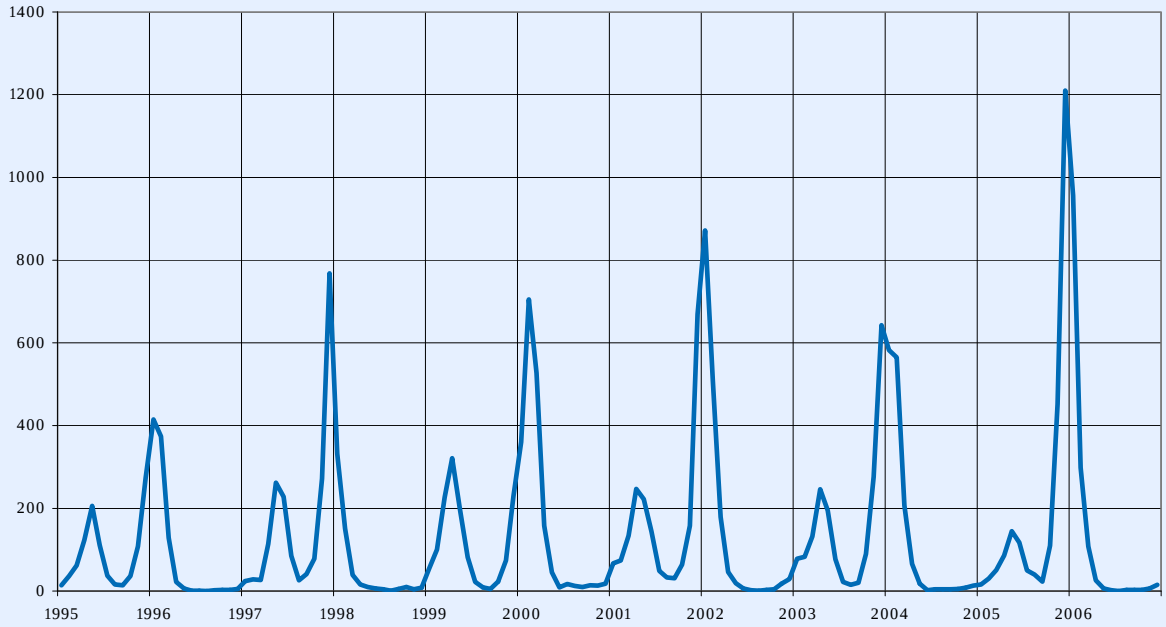
firmed influenza diagnoses in conscripts (sampling, n=99) involved B viruses. The main reason for the differences is probably the fact that the selection of target groups for diagnostics is based on different criteria in different countries and different populations. In garrisons, B infections with mild symptoms may be selected for diagnostics more frequently than in public health care.

Today, the influenza B viruses circulating the world represent two lineages, which separated from each other in the mid-1980s. In accordance with the WHO recommendation, the Jiangsu/10/2003 virus of the Yamagata/16/88 lineage was represented in the autumn 2005 influenza vaccine. However, the dominant virus in Finland in winter 2006 belonged to the Victoria/2/87 lineage and was nearly identical with the virus that caused a local epidemic in Nepal in summer 2005. In Finland, viruses of the Yamagata lineage were isolated in one person only. Therefore, the composition of the vaccine was not optimal with regard to the B virus. In conscripts, a protective antibody level was achieved in only 43 per cent of those vaccinated. Despite the wrong choice of vaccine virus for the Northern Hemisphere, vaccination raised antibodies satisfactorily against the epidemic B virus in conscripts who had previous antigenic experience of viruses of this lineage.

RSV (Respiratory Syncytial Virus)

In 2006, the National Infectious Diseases Register received 1,426 notifications of laboratory-confirmed RSV cases (27/100,000), which is the lowest figure since 1999. In Finland, RSV follows a regular two-year cycle; in uneven years there is a minor outbreak in spring, followed by a more intensive winter outbreak around New Year. In 2006, the winter outbreak peaked as early as in December 2005 and continued until March 2006. Incidences varied by hospital district (8–56/100,000). As before, nine out of ten RSV cases were diagnosed in 0–4-year-olds. Even though infections occur in all age groups, babies and small children constitute the majority of cases leading to hospitalisation and laboratory diagnostics (Figure 2).

Figure 2. RSV (Respitory syncytial virus) by month 1995-2006



Legionella

In 2006, twenty cases of legionella were notified to the Register based on laboratory findings. In five cases, the diagnosis was based on detection of antigen in urine, in six cases on sputum or BAL fluid culture or PCR, and the rest were based on serological methods.

In further investigations, the clinical picture was found to be consistent with legionellosis in 13 cases, in other words, the patient had symptom-based or radiologically diagnosed pneumonia. All the five patients whose legionella was confirmed by a urinary antigen test had pneumonia.

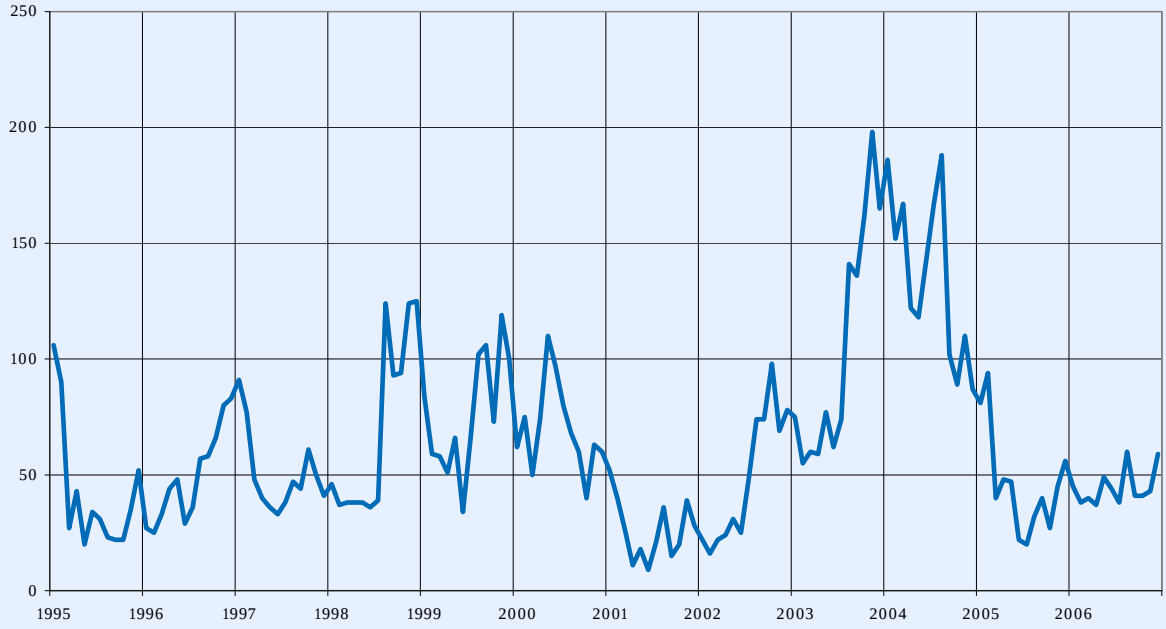
Nine of the patients were men and four were women. Their age ranged from 24 to 76 years. Four patients had been abroad before becoming ill, and three of them had lived in a hotel abroad. The accommodation data of these patients were reported to EWGLINET (the European Surveillance Scheme for Travel Associated Legionaires Disease), which collects data on travel-associated legionella findings. The last diagnosed case in 2006 was related to a disease cluster stemming from a hotel in Phuket, Thailand, with Finnish, Swedish and Norwegian tourists contracting legionellosis.

Whooping cough

In 2006, the number of whooping cough cases notified to the National Infectious Diseases Register totalled 535 (10/100,000). The figure is similar to that of 2005. In the majority of cases, the diagnosis was based on antibody testing. There were 36 findings (6%) in children

under 12 months of age, and half of these in children under three months of age. As previously, schoolchildren constituted the largest patient group, and over 20-year-olds represented about one third of the reported cases. Once again, there was great variance in the incidence between hospital districts (3–52/100,000). The incidence was highest in Åland and lowest in the Länsi-Pohja hospital district. It can be expected that the booster vaccinations administered to 6-year-olds since 2003 and to 4- and 14-year-olds since 2005 will change the epidemiological situation of whooping cough in the next few years. The figures for 2006 do not yet indicate any significant changes in the situation (Figure 3).

Figure 3. Whooping cough (*Bordetella pertussis*) by month 1995-2006



3 INTESTINAL INFECTIONS

Salmonella

There were 2,573 cases of salmonella notified in 2006 and 2,483 cases in the year before. In 2005 and 2006 the number of cases was higher than in the preceding years. Forty-five per cent of the cases were men. Annual incidence in the entire country was 47/100,000 inhabitants. Incidences were highest in the hospital districts of Itä-Savo (67/100,000) and Helsinki and Uusimaa (65/100,000) and lowest in the hospital districts of Länsi-Pohja (35/100,000) and Päijät-Häme (35/100,000). Incidences were highest (70/100,000) among 20–54-year-olds and lowest (10/100,000) among those over 75 years of age.

The most common *Salmonella* serotypes were Enteritidis (1,012 cases), Typhimurium (333), Stanley (131), Virchow (100) and Newport (77). More than one salmonella serotypes were detected in more than 20 cases.

There were five diagnosed cases of *S*. Typhi, which causes typhoid, three cases of *S*. Paratyphi A, which causes paratyphoid, and one case of *S*. Paratyphi B. Travel data were available for three *S*. Typhi patients and three *S*. Paratyphi patients. Their infections were all acquired in India.

Of salmonella cases, 432 (18%) were acquired in Finland and 2,025 (82%) abroad. No country of acquisition was specified in 152 cases (6%). The total number of domestically acquired infections was similar to the figure in 2005 (442 cases), and their incidences was 7.5/100,000 inhabitants. The majority (170 cases, 43%) of domestically acquired cases were caused by the *S*. Typhimurium serotype, and the prevailing phage types were FT 1 (53%) and FT NST (14%; not specific type) and FT 104 (5%). The second most common serotype in domestic cases was *S.* Enteritidis with 69 diagnosed cases. The Enteridis serotype is not known to have a permanent reservoir in Finnish livestock.

The total number of salmonella infections acquired abroad was 2,025 and the incidence was 38/100,000 inhabitants. The *S*. Enteritidis serotype caused 879 (43%) of the cases with foreign origin. The prevailing phage types among these were FT 4 (23%), FT1 (25%) and FT 21 (14%). The next most common serotypes acquired abroad were Typhimurium (140 cases), Stanley (116), Virchow (80) and Newport (66). The prevailing phage types among Typhimurium cases acquired abroad were FT NST (26%; not specific type) and FT 104 (11%). The most common countries of acquisition were Thailand (21%), Spain (7%), Bulgaria (6%), India (4%), Greece (4%) and Brazil (3%).

Nalidixic acid is used in epidemiological susceptibility testing, and data on resistance to nalidixic acid can be used to predict reduced susceptibility (MIC ≥ 0.125 mg/L) to fluoroquinolones. Twenty-four per cent of foreign strains were resistant to nalidixic acid. Ninety-four per cent of these showed reduced susceptibility to ciprofloxacin and two per cent were completely resistant (MIC ≥ 4.0 mg/L). The completely resistant strains represented the Kentucky serotype, with the exception of one Typhimurium strain (Figure 4, Table 1).

Figure 4. Salmonella and Campylobacter cases by month 1995-2006

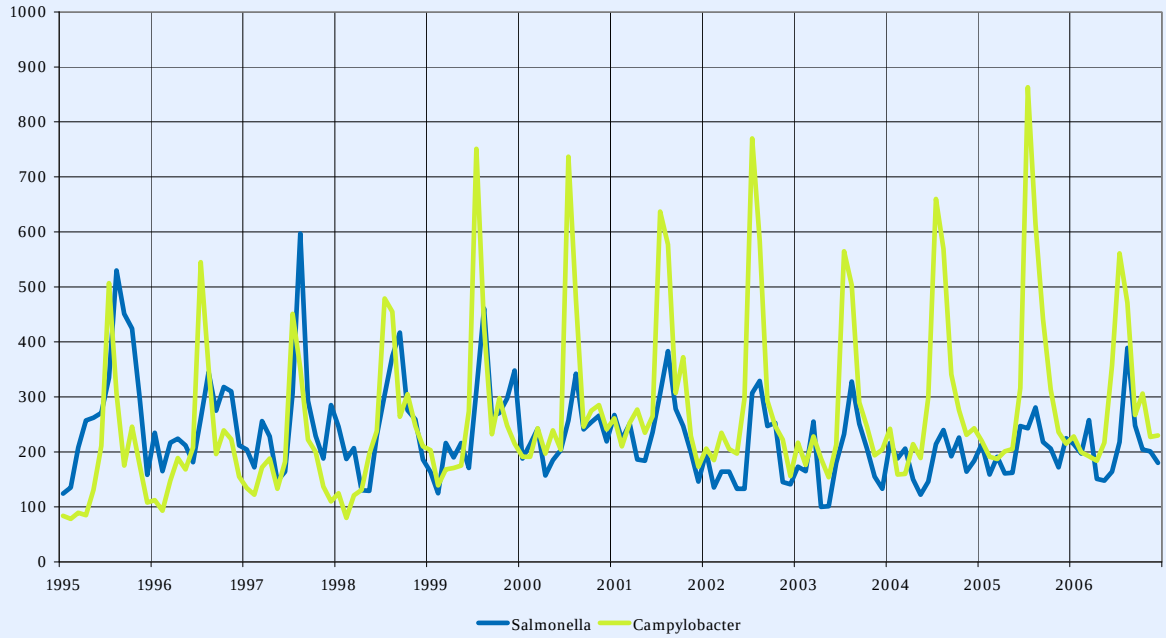


Table 1. The most common serotypes of salmonella cases 1997-2006 (S. Typhi and S. Paratyphi not included)

	1997		1998		1999		2000		2001
Domestically acquired infections									
Salmonella Typhimurium	499	Salmonella Typhimurium	222	Salmonella Typhimurium	375	Salmonella Typhimurium	124	Salmonella Typhimurium	152
Salmonella Enteritidis	79	Salmonella Newport	66	Salmonella Agona	85	Salmonella Enteritidis	52	Salmonella Enteritidis	63
Salmonella Hadar	31	Salmonella Enteritidis	59	Salmonelle Enteritidis	83	Salmonella Agona	27	Salmonella Agona	41
Salmonella Infantis	24	Salmonella Saintpaul	22	Salmonella Hadar	10	Salmonella Hadar	17	Salmonella Infantis	19
Salmonella Newport	22	Salmonella Infantis	21	Salmonella Poona	10	Salmonella Virchow	15	Salmonella Ohio	12
others	126	others	121	others	93	others	90	others	103
total	781		511		656		325		390
Infections acquired abroad									
Salmonella Enteritidis	912	Salmonella Enteritidis	944	Salmonella Enteritidis	892	Salmonella Enteritidis	1046	Salmonella Enteritidis	1238
Salmonella Typhimurium	159	Salmonella Typhimurium	133	Salmonnella Hadar	112	Salmonella Typhimurium	204	Salmonella Typhimurium	139
Salmonella Virchow	85	Salmonella Virchow	82	Salmonella Typhimurium	103	Salmonella Hadar	125	Salmonella Hadar	96
Salmonella Hadar	57	Salmonella Hadar	79	Salmonella Virchow	76	Salmonella Braenderup	49	Salmonella Virchow	79
Salmonella Newport	34	Salmonella Infantis	67	Salmonella Braenderup	38	Salmonella Virchow	49	Salmonella Stanley	62
others	733	others	827	others	680	others	747	others	757
total	1980		2132		1901		2220		2371
Country of acquisition not specified									
number of cases	231		301		476		223		145
Total	**2992**		**2994**		**3033**		**145**		**2906**

	2002		2003		2004		2005		2006
Domestically acquired infections									
Salmonella Typhimurium	224	Salmonella Typhimurium	137	Salmonella Typhimurium	125	Salmonella Typhimurium	240	Salmonella Typhimurium	170
Salmonella Enteritidis	42	Salmonella Enteritidis	61	Salmonella Enteritidis	78	Salmonella Enteritidis	75	Salmonella Enteritidis	69
Salmonella Hvittingfoss	26	Salmonella Newport	16	Salmonella Agona	27	Salmonella Agona	32	Salmonella Give	39
Salmonella Agona	16	Salmonella Agona	12	Salmonella Stanley	7	Salmonella Infantis	10	Salmonella Virchow	11
Salmonella Abony	15	Salmonella Poona	9	Salmonella Newport	7	Salmonella Stanley	5	Salmonella Newport	9
others	86	others	75	others	76	others	80	others	98
total	409		310		320		442		396
Infections acquired abroad									
Salmonella Enteritidis	905	Salmonella Enteritidis	887	Salmonella Enteritidis	738	Salmonella Enteritidis	833	Salmonella Enteritidis	879
Salmonella Typhimurium	115	Salmonella Typhimurium	155	Salmonella Typhimurium	177	Salmonella Typhimurium	194	Salmonella Typhimurium	140
Salmonella Hadar	69	Salmonella Stanley	67	Salmonella Stanley	104	Salmonella Stanley	113	Salmonella Stanley	116
Salmonella Stanley	64	Salmonella Virchow	67	Salmonella Virchow	74	Salmonella Virchow	87	Salmonella Virchow	80
Salmonella Virchow	55	Salmonella Hadar	58	Salmonella Newport	52	Salmonella Corvallis	60	Salmonella Newport	66
others	637	others	628	others	652	others	654	others	744
total	1845		1862		1795		1941		2025
Country of acquisition not specified									
number of cases	103		107		139		111		152
Total	**2357**		**2279**		**2254**		**2768**		**2573**

Campylobacter

In 2006, the National Infectious Diseases Register received 3,439 notifications of campylobacter infections. The figure is more than 500 (14%) lower than in 2004. *Campylobacter jejuni* was clearly the prevailing campylobacter species (2,871 cases). There were 132 noti-

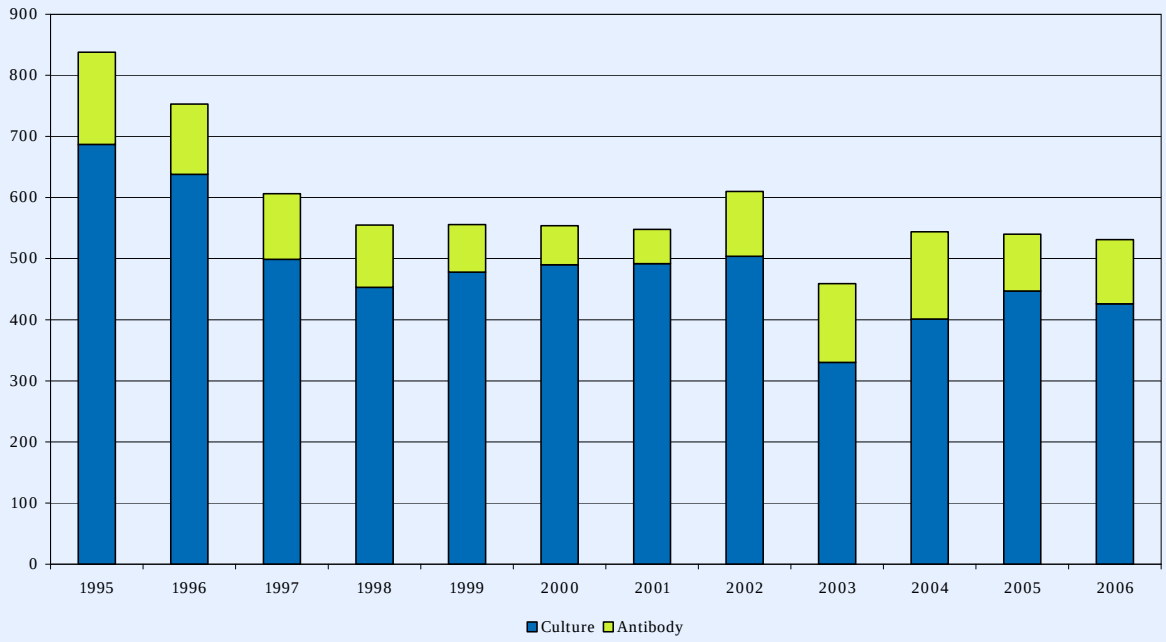
fied cases of *C. coli* and 432 campylobacter findings without species specification. The incidence in the entire population was 65/100,000. Fifty-four per cent of the patients were men. The majority of notified cases were diagnosed in 20–39-year-olds, with an incidence rate of 119/100,000. Helsinki and Uusimaa was the hospital district with clearly the highest incidence (109/100,000). The lowest incidences were reported in the hospital districts of Åland (19/100,000), Itä-Savo (27/100,000) and Kainuu (28/100,000). The seasonal variation was characteristic for campylobacter, with clearly the highest incidence in July–August.

In 2,554 cases (74%) information was obtained about preceding travelling abroad. Eighty per cent of these patients had been abroad just prior to becoming ill. The most common countries of acquisition were Thailand (213 cases), Spain (210), Bulgaria (192), India (154) and Turkey (112) (Figure 4).

Yersinia enterocolitica

The number of *Yersinia enterocolitica* cases did not change from 2005 (543) to 2006 (533). However, since 1995 (873), the number of cases has gradually decreased. This is mainly the result of a decreased number cases in children. In 2006, the incidence in the entire country was 10/100,000. There is great regional variation in the incidences. The incidences were highest in the hospital districts of Kainuu (25/100,000) and Helsinki and Uusimaa (20/100,000), lowest in the hospital district of Etelä-Savo (1/100,000). Since 1995, the incidence has fallen considerably among children under 5 years of age, while it has increased among those over 75 years of age (Figure 5).

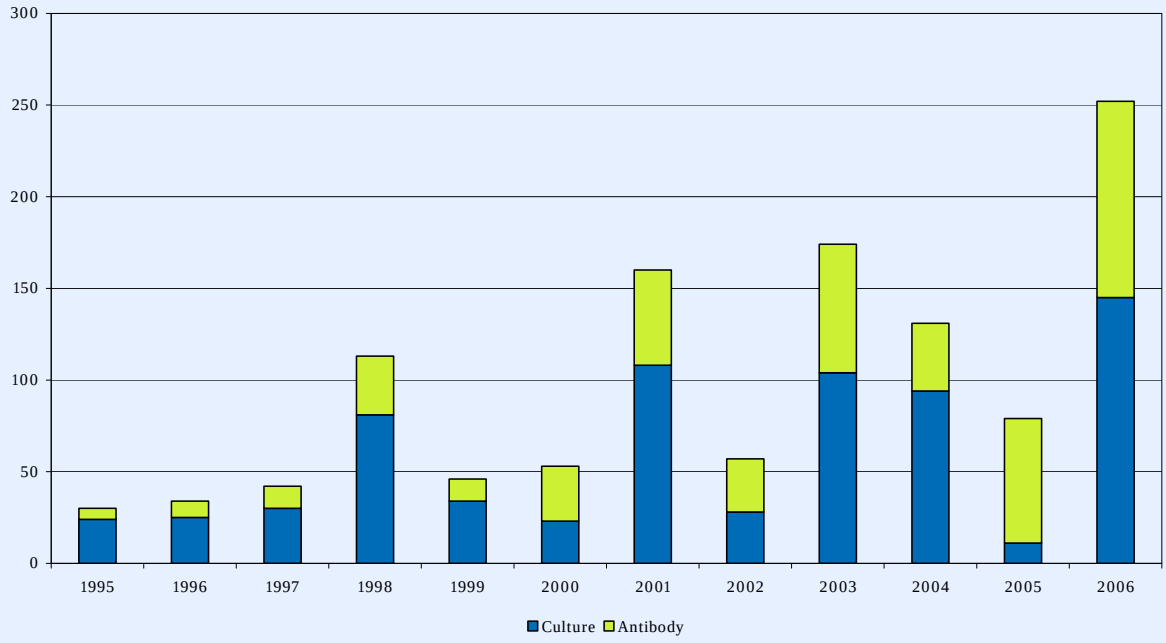
Figure 5. *Yersinia enterocolitica* findings 1995-2006



Yersinia pseudotuberculosis

The number of *Yersinia pseudotuberculosis* cases rose remarkably from 2005 (79) to 2006 (252). This is explained by the *Y. pseudotuberculosis* outbreaks in Pohjois-Karjala and Keski-Uusimaa in 2006. No distinct incidence trend can be detected; in several years outbreaks have caused great variation in the number of cases. In 2006, the incidence in the entire country was less than 5/100,000 inhabitants. In the hospital districts of Helsinki and Uusimaa and Pohjois-Karjala the incidence was 13/100,000 inhabitants. No cases were diagnosed in three hospital districts: Päijät-Häme, Itä-Savo and Länsi-Pohja (Figure 6).

Figure 6. *Yersinia pseudotuberculosis* findings 1995-2006



Shigella

In 2006, the incidence of shigellosis was 1.4/100,000. There were 74 notified cases, 29 in men and 45 in women. The incidence was highest among 25–49-year-olds. More than half of the cases (42) were diagnosed in the Helsinki and Uusimaa hospital district, where the incidence was also higher than in the other hospital districts (3/100,000). Eight hospital districts had no diagnosed cases. Sixty-seven of the infections were acquired abroad; six in Finland and in one case the country of acquisition was not specified. The prevailing shigella species were *Shigella sonnei* (44 cases) and *S. flexneri* (25 cases). There were only two cases of *S. dysenteriae*. The most common countries of acquisition were Egypt (20) and India (19).

About 85 per cent of the shigella strains were resistant to at least four antimicrobials, about 30 per cent were resistant to nalidixic acid and about 25 per cent of the strains had reduced susceptibility to ciprofloxacin (MIC at least 0.125 mg/L). The strains from Egypt,

however, were susceptible to ciprofloxacin, while most of the strains from India had impaired susceptibility to ciprofloxacin. *S. flexneri* serotype 2a strains from India showed the highest resistance to ciprofloxacin (MIC at least 3 mg/L).

Enterohaemorrhagic *Escherichia coli* EHEC

Fourteen microbiologically confirmed cases of enterohaemorrhagic *Escherichia coli* (EHEC) were notified to the National Infectious Diseases Register (0.3/100,000/year). This was similar to the usual figures observed in recent years. Eight cases were diagnosed in women and six in men. Nine cases were under 15 years old, four of them 0–4 years of age. In three children, the infection led to haemolytic-uremic syndrome (HUS). In six cases the infection was acquired abroad.

Serogroup O157 strains caused eight infections, and two of these were caused by the rare sorbitol-positive, immobile O157:H^- clone. Both cases were children.

Six of all the EHEC cases were caused by an EHEC non-O157 serogroup, five of these of Finnish origin. Two of the domestic EHEC non-O157 infections were caused by the O145:H^- serotype. In addition, there were four sporadic cases caused by other non-O157 groups, one of them of foreign origin.

Norovirus

In 2006 there were 645 notified cases of norovirus, 410 of them (64%) in women. The incidence, 12.3/100,000, was clearly higher than in the three preceding years. Nearly half of the cases were notified in November and December. About one case in three was diagnosed in the group of 75-year-olds, with an incidence of 57.8/100,000, but infections were detected in all age groups. The hospital districts of Satakunta, Varsinais-Suomi and Kainuu had the highest incidences.

The accumulation of norovirus cases in the latter part of the year was the result of a large number of outbreaks in institutions, particularly in hospitals and old people's homes. This also explains the high incidence among the elderly and the considerable regional differences. In the background of the numerous outbreaks toward the end of the year, is the emergence of new genotype GII.4 norovirus variants (GII4-2006a and GII4-2006b). These virus types had already caused outbreaks on cruise ships on the North Atlantic and the Baltic Sea in summer 2006, and later in autumn they were the cause of institutional outbreaks in numerous European countries. Similar extensive outbreaks caused by new virus variants were also observed in 1996, 2002 and 2004, but the outbreak in 2004 was not very strong in Finland.

Rotavirus

In 2006, there were 2,191 notified rotavirus cases, with an incidence of 42/100,000. Of these, 1,201 were diagnosed in men and 990 in women. The number of cases was higher than ever in the history of the National Infectious Diseases Register. The monthly variation followed the normal pattern: the number of cases rose distinctly in January, peaked in March and declined in April–June. The incidence was clearly highest among children under five years of age (705/100,000); they constituted 92 per cent of all diagnosed cases. Cases were notified from all hospital districts, with the highest incidences in the hospital districts of Satakunta (86/100,000), Etelä-Pohjanmaa (82/100,000) and Päijät-Häme (72/100,000).

Listeria

Forty-five infections caused by the *Listeria monocytogenes* bacterium were notified in 2006. Forty-nine per cent of these were men and 64 per cent were 65 years of age or older. The annual incidence of listeriosis was 8.5 cases per million inhabitants.

The listeria findings consisted of 38 (84%) findings from blood, five findings from cerebrospinal fluid and two findings from other needle aspirates.

In 18 cases the patient had a severe underlying disease as a predisposing factor. In all, five (11%) cases died. Three infections were associated with pregnancy, and one child died of listeriosis. Listeriosis was diagnosed in nearly all hospital districts with the number of cases ranging from zero to five.

Serotype 1/2 caused 80 per cent of the infections, and serotype 4b caused 18 per cent. Toward the end of 2006, two disease clusters were detected that were caused by genetically similar *Listeria monocytogenes* types. One of these included four cases and the other one six. To prevent further cases, the Finnish Food Safety Authority (Evira) and the National Public Health Institute provided an information sheet for consumers on foods involving a listeriosis risk.

Significant food- and water-borne outbreaks

In 2006, the National Public Health Institute received 79 notifications of suspected food- or water-borne outbreaks. These included two *Yersinia pseudotuberculosis* outbreaks that led to extensive investigations, as well as two significant norovirus outbreaks. Several other intestinal infection clusters were also observed.

Norovirus outbreak at a spa in Eastern Finland

In March, more than 90 people experienced gastrointestinal symptoms at a spa hotel in Eastern Finland, including both staff and customers. Genogroup 2 norovirus was detected in all the tested stool samples (5/5).

The accumulation of cases on one day suggests that the origin of the outbreak was a point source, like food or an event associated with eating.

However, in the conducted questionnaire study no food was found to have any statistically significant association to the symptoms. No pathogens were detected in the examined foods either.

A large number and high turnover rate of customers, as well as favourable conditions for the virus, like bathing water, common WCs and other spa premises, increase the possibility of norovirus outbreaks. The spa initiated preventive measures immediately, and the number of cases fell rapidly.

Extensive norovirus outbreak in Pirkanmaa

In July, more than 400 persons contracted gastrointestinal disease in Pirkanmaa. The majority of patients were customers of various lunch restaurants. The extent, clinical picture and origin of the outbreak were investigated by several questionnaire studies, involving customers of nine lunch restaurants in Tampere and one lunch restaurant in Valkeakoski. Genogroup 2 norovirus was isolated from the samples of customers of five lunch restaurants. The questionnaire study indicated that eating fresh produce at the restaurants increased the risk of illness. Tracing revealed that the restaurants used the same supplier of fresh vegetables. However, no norovirus could be identified in the samples collected from food at the restaurants and from the fresh produce supplier. No defects were detected in the handling of products at the vegetable supplier's premises.

***Yersinia pseudotuberculosis* outbreak in Nurmes**

In May, nearly 60 people in Nurmes contracted a gastrointestinal disease caused by the *Yersinia pseudotuberculosis* bacterium. The majority of the patients were schoolchildren or children in day care. The same farmer supplied carrots to both schools and day care centres.

Yersinia pseudotuberculosis bacterium was detected in the samples collected from the patients as well as in the surface contamination and carrot samples collected from the farmer's storerooms. Typing tests showed that the bacterial strains were identical to each other.

During the outbreak investigation, 50 patients were interviewed by telephone. The outcome of the questionnaire study supported the results obtained from the patient and environmental samples and the laboratory findings; nearly all patients who had eaten at school had eaten raw carrot.

Extensive *Yersinia pseudotuberculosis* outbreak in Keski-Uusimaa

In August–September, more than 400 people were taken ill in Tuusula and Kerava during a *Yersinia pseudotuberculosis* outbreak. Most patients were children from 20 schools and five day care centres.

The outbreak was investigated at a school centre in Tuusula by conducting a questionnaire study with more than 800 participants. The study revealed a connection between the illness and eating carrots.

Food tracing revealed that the schools in Tuusula and Kerava used the same supplier of fresh produce. The schools had received grated carrot from bad quality carrots.

Y. pseudotuberculosis was detected in the patient samples and in the samples collected from the storerooms of the company supplying carrots to the schools and day care centres. Typing tests showed that the bacterial strains were identical to each other.

4 HEPATITIDES

Hepatitis A

In 2006, only 26 hepatitis A cases were notified to the National Infectious Diseases Register (incidence 0.5/100,000), which is the same as in 2005. Thirteen cases were men and thirteen were women. Eleven hospital districts had no diagnosed cases. The highest number of cases, six, was diagnosed in the age group 20–24-year-olds. Five patients were over 75 years old and four were under five years of age. Eleven infections were acquired abroad, seven in Finland, one either in Finland or Norway and in seven cases the country of acquisition was not specified. Two infections acquired in Finland were transmitted by a close relative who had taken ill after travelling abroad.

After the epidemics among injecting drug users in 2002–2003, the incidence of hepatitis A has remained low, probably reflecting the effect of vaccinations aimed at risk groups. The family of a hepatitis A patient must always be protected by gamma globulin or vaccination.

Hepatitis B

Only 37 acute hepatitis B cases were notified to the National Infectious Diseases Register, which is just slightly more than a tenth of the record figure in 1997. In 2006 there were no signs of clusters that have been described in previous years.

Twenty-two patients were men and fifteen were women. The majority of cases (19) were diagnosed in the Helsinki and Uusimaa hospital district. Eight hospital districts had no diagnosed cases. The number of diagnosed infections has fallen particularly among young and middle-aged adults.

It seems that including hepatitis B vaccinations in the general vaccination programme for risk groups, as well as the health counselling and harm reduction work targeted at injecting drug users have yielded the desired results (Figure 7, Table 2).

Figure 7. Acute Hepatitis B cases, injecting drugs and sex infections 1998-2006

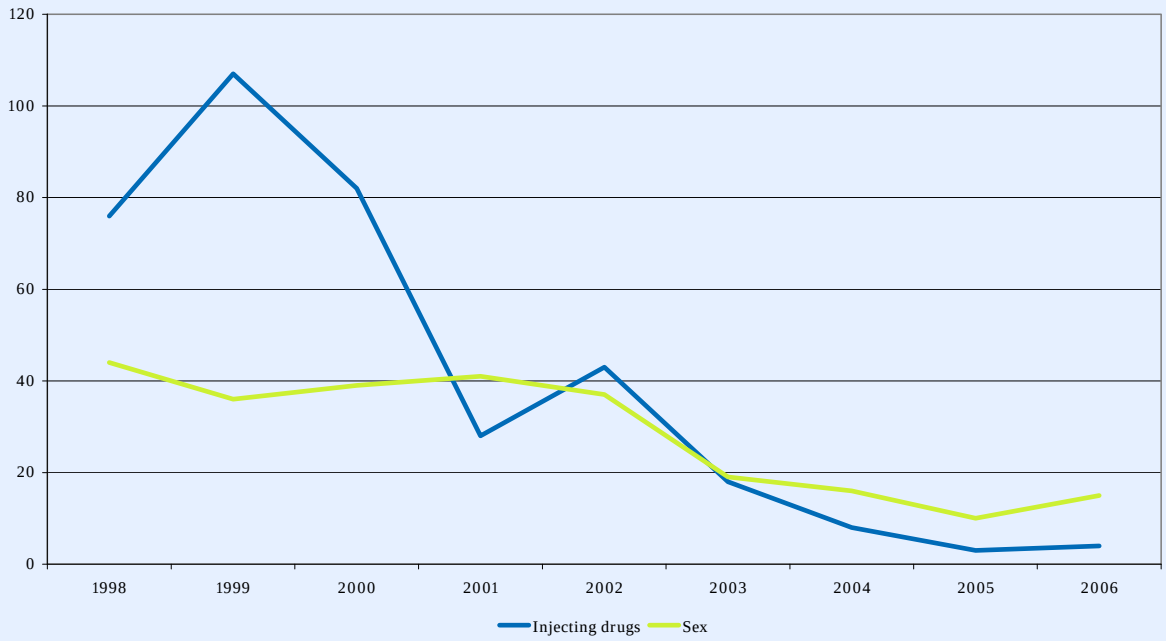


Table 2. Acute Hepatitis B cases by mode of transmission 1998-2006

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Injecting drugs	76	107	82	28	43	18	8	3	4
Sex	44	36	39	41	37	19	16	10	15
Perinatal	1	1	1	-	1	1	-	-	-
Blood products	4	1	1	1	1	-	3	-	-
Other	4	9	8	6	2	1	4	3	2
Unknown	117	103	108	51	93	67	27	18	16
Total	246	257	239	127	177	106	58	34	37

Hepatitis C

The number of hepatitis C cases fell only slightly in 2006 compared with 2005. In recent years, the reduction rate has slowed down, even though in Southern Finland the downward trend that began at the end of the 1990s is still continuing. It is difficult to separate acute hepatitis C infections from those acquired years ago, which is why the changes in the figures should be interpreted cautiously.

With regard to age groups, the number of cases among 20–24-year-olds has increased or remained at the previous level in the three past years. Among cases with information about the probable mode of transmission, most infections are still associated with injecting drug use. The prevalence of hepatitis C is so high among injecting drug users that changes in prevalence are very slow, even if the risks are under improving control. It seems that health counselling to injecting drug users and harm reduction yielded the best results in Southern Finland.

Among the provinces, the number and incidence of hepatitis C infections have decreased most significantly in the province of Southern Finland. The incidence has fallen by nearly half from the top figure 56/100,000 recorded in 1997: in 2006 the incidence was about 27/100,000. The same development can be seen at hospital district level; the Helsinki and Uusimaa hospital district has a similar proportional reduction. In 2006, the incidence in the Helsinki and Uusimaa hospital district was about 28/100,000.

At hospital district level, Varsinais-Suomi and Kymenlaakso had the highest incidence (31–32/100,000). When comparing the figures, the effect on random variation of the smaller base population and lower number of cases must be kept in mind (Figure 8, Table 3).

Figure 8. Reported Hepatitis C cases according to age 1998-2005

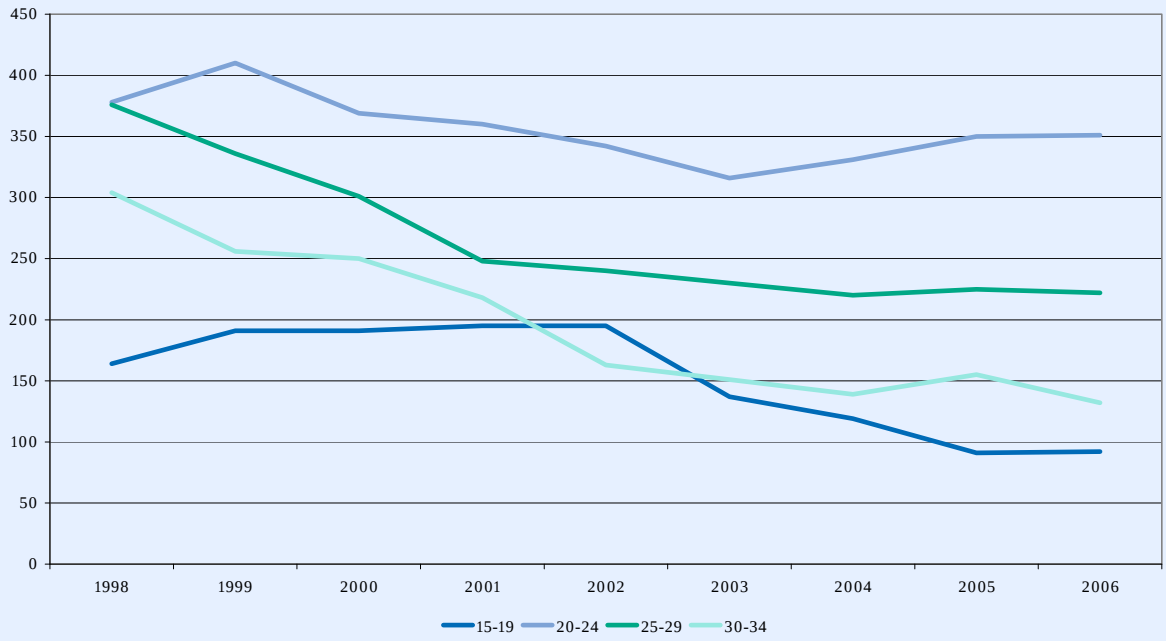


Table 3. Hepatitis C cases my mode of transmission 1998-2005

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Injecting drugs	1045	996	926	821	704	626	599	619	537
Sex	55	35	41	42	46	46	60	61	63
Perinatal	4	10	6	3	3	1	10	5	8
Blood products	26	22	25	18	18	22	18	24	7
Other	24	40	31	31	28	34	31	34	37
Unknown	649	649	710	576	572	534	520	500	523
Total	1803	1752	1739	1491	1371	1263	1238	1243	1175

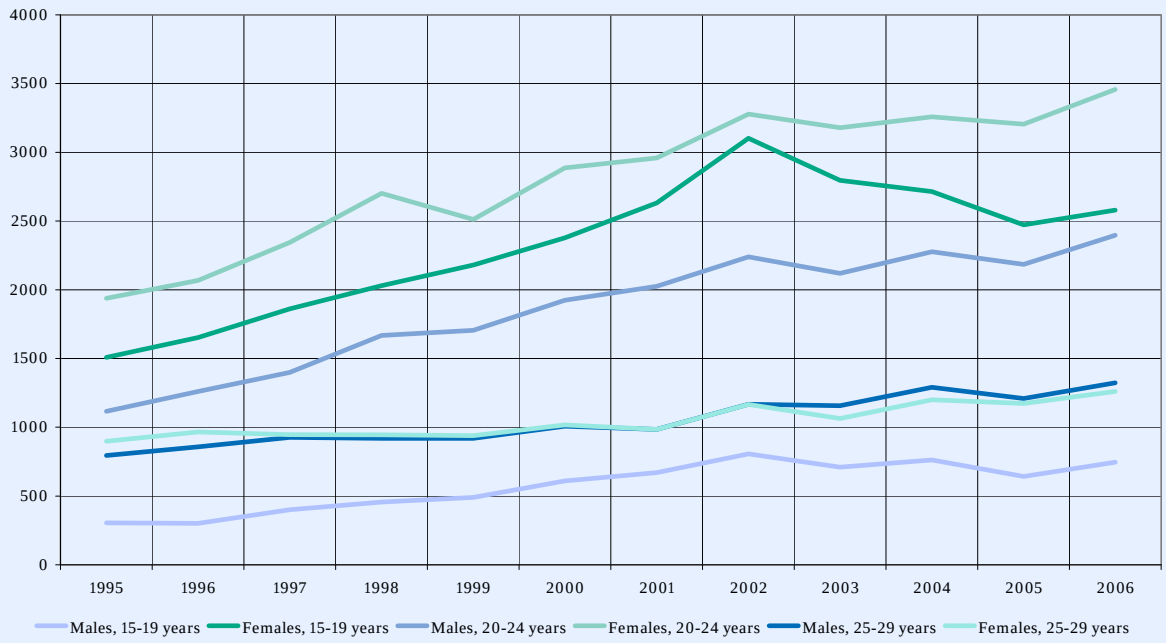
5 SEXUALLY TRANSMITTED DISEASES

Chlamydia *(Chlamydia trachomatis)*

There were 13,854 notified cases of chlamydia in 2006, which is nearly 1,000 cases more than in 2005, when there were 12,721 notified cases. The incidence was 263/100,000. As earlier, the highest incidences were reported in the hospital districts of Åland (369/100,000) and Lappi (399/100,000).

Sixty per cent of the cases were women. The majority of cases were diagnosed in 15–24-year-old women and 20–24-year-old men. Among under 20-year-olds, women constituted a considerably larger group of cases (2,580) compared with men (745), as previously (Figure 9).

Figure 9. Chlamydia in the age groups of young adults 1995-2005



Gonorrhoea (*Neisseria gonorrhoeae)*

The number of diagnosed gonorrhoea cases remained about the same as before. The National Infectious Diseases Register received 235 notifications of gonorrhoea. The majority of patients were 15–55 years of age. Seventy-three per cent of these were men. The country of acquisition was specified in 82 per cent of infections in men. In 82 per cent of cases with an identified country of acquisition, it was other than Finland. Forty-one infections (30%) were acquired in the Far East and nine (16%) in Russia. Twelve infections in women were acquired abroad (Table 4).

Table 4. Gonorrhoea infections acquired domestically and abroad 1995-2006

	1995	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Domestically acquired infections	185	185	83	94	100	108	129	113	100	89	133	126	109
Infections acquired abroad	130	130	88	75	98	85	105	80	82	59	72	70	126
Russia	70	70	50	42	49	42	48	34	28	9	7	22	11
Thailand	9	9	9	7	16	19	18	17	31	27	38	28	42
Estonia	26	26	9	7	9	8	7	3	5	2	6	1	-
others	25	25	20	19	24	16	32	26	18	21	21	19	24
Place of acquisition unknown	63	63	55	49	71	62	50	54	53	41	47	44	49
Total	378	378	226	218	269	255	284	247	235	189	252	240	361

Syphilis *(Treponema pallidum)*

There were 130 notified cases of syphilis in 2006, which is slightly less than in 2005 (147 cases). Fifty-five per cent of all syphilis cases were diagnosed in the age group 25–50-year-olds, and among these, 30 per cent of the cases were women under 30 years of age. The highest incidences were in the hospital districts of Etelä-Savo, Etelä-Karjala, Kymenlaakso and Helsinki and Uusimaa.

More than 20 per cent of the notified cases were detected in over 75-year-olds; the majority of these are probably serological scars due to a previous infection. More than half of the cases were diagnosed in men, like in previous years.

The country of acquisition was specified in 43 per cent of infections in men, and in 70 per cent of these the infection had been acquired abroad, most often in Russia (14). The country of acquisition was identified in 36 per cent of infections in women. Nine women had acquired the infection in Finland and five in Russia (Table 5).

Table 5. Syphilis infections acquired domestically and abroad 1995-2006

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Domestically acquired infections	48	53	50	46	21	54	31	24	30	22	24	18
Infections acquired abroad	64	81	70	60	62	101	64	36	41	29	48	37
Russia	49	57	48	33	43	80	49	21	18	15	23	14
Estonia	5	11	5	5	3	3	2	1	6	1	6	3
Somalia	-	1	2	5	2	-	1	2	2	-	3	3
Thailand	1	-	1	4	-	1	1	-	1	2	1	1
others	9	12	14	13	14	17	11	12	14	11	15	16
Place of acquisition uknown	57	85	52	81	57	49	64	68	62	55	73	75
Total	169	219	172	187	140	204	159	128	133	106	145	130

HIV infection

In 2006, the number of newly diagnosed HIV cases was clearly higher than the year before. There were 194 new cases, which means an approximately 40 per cent increase from the previous year. It is of note that the increase is due to the trend in sexually transmitted HIV infections that has continued throughout the 2000s. This trend was particularly distinct in 2006. The increase of sexually transmitted infections has not been clearly reflected in the overall figures, as the number of infections transmitted by injecting drugs has decreased due to active measures remarkably while sexually transmitted infections have increased.

The HIV infection also broke other statistical records in 2006: the total number of HIV infections diagnosed in Finland exceeded 2,000, and the number of surviving with known HIV infection rose above a thousand.

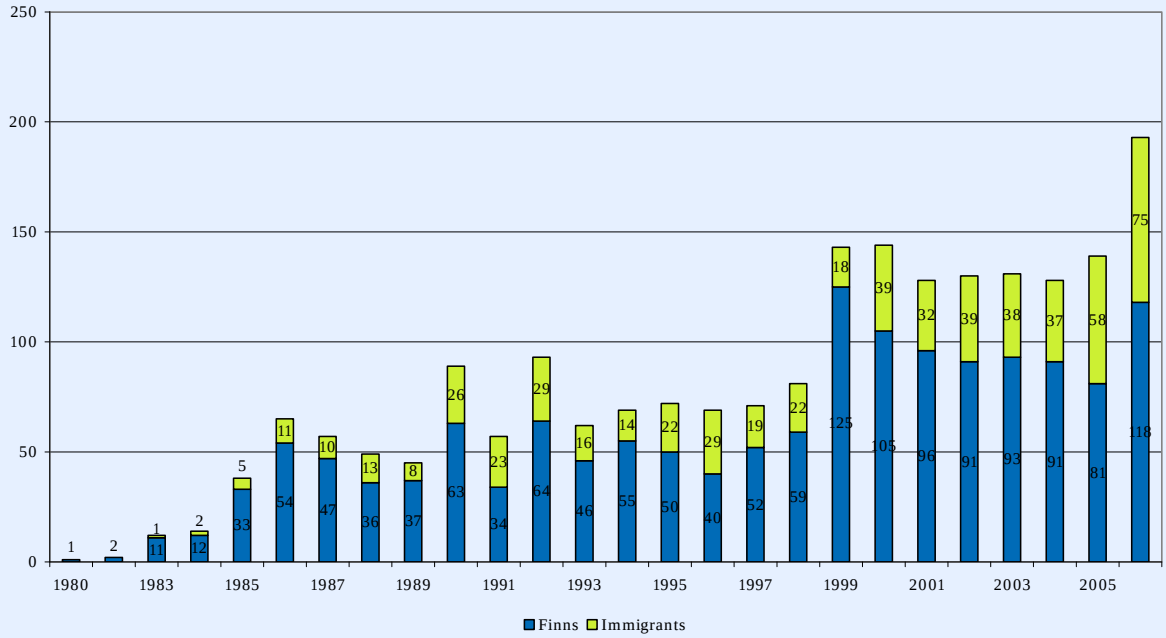
The increase in sexually transmitted infections cannot be explained by any single factor. The rise is visible both among Finns and other nationalities. The latter do not directly influence the epidemic in Finland, but they are the group with a great need for targeted health counselling.

Among Finns, sexually transmitted HIV infections have increased both in men who have sex with men and in heterosex. In both transmission categories, the number of cases has more than doubled since the beginning of the 2000s. This may be a sign of the population not realising the importance of safe sex.

The risk of acquiring a sexually transmitted HIV infection in Finland has not decreased, quite the contrary. The number of persons living with HIV infection is growing continuously, due to the chronic nature of the infection and an improved life expectancy. Therefore, the risk of acquiring the infection in Finland is growing, albeit slowly.

As HIV infections are becoming increasingly common in Finland, the same can be said of our nearby regions and important tourist destinations, like Southeast Asia, where the risk of infection is continuously increasing. In addition, HIV infections are still quite common in special groups, like among men having sex with men.

Figure 10. Hiv cases detected among Finns and immigrants 1980-2006



According to the prevalence study conducted by the National Public Health Institute among homosexual and bisexual men in 2006, nearly five per cent of the participants were HIV positive. The chronic nature of the infection means that the reduction in prevalence takes a long time, and therefore the situation cannot change very rapidly (Figure 10).

6 MYCOBACTERIAL INFECTIONS

Tuberculosis – Mycobacterium tuberculosis

Since 1995, the registered tuberculosis cases include all cases confirmed by culture, as notified by the laboratories. In addition, cases notified by a physician only, are included if the diagnosis is based on histology or a case of pulmonary tuberculosis is confirmed by positive sputum staining for tuberculosis bacilli.

In 2006, there were 293 diagnosed cases of tuberculosis, which is 19 per cent less than in 2005 (361 cases).

The marked reduction in the number of cases, falling below 300 per year for the first time, showed that the increase in the previous year was just a temporary incident.

The number of culture-confirmed cases of tuberculosis in 2006 was 266, which is 16 per cent less than in 2005 (316 cases).

The incidence of tuberculosis was 5.6/100,000 inhabitants.

Based on physicians' notifications, 15 (5%) cases had previous history of tuberculosis diagnosed after the year 1950, when anti-tuberculosis medication became available.

There were 210 cases of pulmonary tuberculosis (incidence 4.0/100,000) and 83 cases of other forms of tuberculosis. Physicians reported positive sputum staining for tuberculosis bacilli in 96 cases of pulmonary tuberculosis (46 %). In 10 per cent of cases no staining was performed or the data were missing.

One of the cases (0.5 %) was notified in under 15-year-olds, 34 (12 %) in 15–29-year-olds, 38 (13 %) in 30–44-year-olds, 51 (17 %) in 45–59-olds, 77 (26 %) in 60–74-year-olds and 92 (31 %) in 75-year-olds or older.

In 2006, the median age of the cases was 65 years. Among caseswith Finnish origin, the median age was 70 years.

Table 6. Incidence of tuberculosis in Finland 1995-2006

Year	Pulmonary tuberculosis				Other tuberculosis		All cases			
	Cases	Incidence / 100 000	Positive sputum	Incidence of positive sputum stains / 100 000	Cases	Incidence / 100 000	Cases	Incidence / 100 000	Culture-confirmed cases	Proportion of culture-confirmed cases (%)
1995	435	8,5	243	4,8	227	4,5	662	13	472	71,3
1996	432	8,4	241	4,7	213	4,2	645	12,6	510	79,1
1997	363	7,1	188	3,7	212	4,1	575	11,2	435	75,7
1998	397	7,7	201	3,9	231	4,5	628	12,2	491	78,2
1999	382	7,4	180	3,5	183	3,5	565	11	487	86,2
2000	370	7,2	227	4,4	167	3,2	537	10,4	451	84
2001	315	6,1	158	3	178	3,4	493	9,5	411	83,4
2002	296	5,7	138	2,7	176	3,4	472	9,1	391	82,8
2003	291	5,6	148	2,8	121	2,3	412	7,9	347	84,2
2004	230	4,4	127	2,4	101	1,9	331	6,3	286	86,4
2005	263	5,0	135	2,6	98	1,9	361	6,9	316	87,5
2006	210	4,0	96	1,8	83	1,6	293	5,6	266	90,8

In 2006, 54 notified cases of tuberculosis (18 % of all cases) were born abroad or were citizens of other countries. One (2 %) of them was under 15 years of age, and 48 (89 %) were 15–44 years old. Thirty-one cases (57 %) were pulmonary tuberculosis and twenty-three (43 %) other forms of tuberculosis.

The susceptibility of Mycobacterium tuberculosis strains is still good. In 2006, two (1%) multiply resistant (MDR, resistant at least to isoniazid and rifampicin) *M. tuberculosis* strains were detected. One of them was found in a Finnish-born adolescent who had been in Africa and the other in a foreign-born adolescent.

In five of the tuberculosis cases notified in 2006 the person also had an HIV infection. In three cases both infections were diagnosed in the same year (Table 6).

Molecular epidemiology of tuberculosis

Targeted genotyping of *M. tuberculosis* strains was continued in 2006 for cases relating to the tracing of transmission chains.

In late summer 2006, the connection between three patients in a nursing home and one adolescent was investigated. Based on the typing results, one patient strain and the strain detected in the adolescent belonged to the same genotype, common in Helsinki, which was first found in a dog in 1996. The second strain was of a closely related type and the third strain did not belong to any known cluster.

The spread of two previously detected clusters was investigated in Central Finland and Lapland. New strains were detected in Keuruu, both belonging and not belonging to the cluster, but the cluster detected earlier in Ranua did not spread.

Four cases attending adult high school had a common contact that was suspected to be the source of infection. However, this proved unlikely, as all the strains turned out to be of different genotypes.

In Varsinais-Suomi, contact tracing of two cases confirmed that they belonged to the same, molecular epidemiologically detected cluster, which confirmed their epidemiological association.

Genotype comparison of a strain isolated in 2006 with the strain isolated from the same person three years earlier indicated that the disease had recurred, as the genotypes were identical to each other.

Mycobacterium bovis BCG

In 2006, the National Infectious Diseases Register received 13 notifications of *Mycobacterium bovis* BCG. The notifications from laboratories are based on culture positivity.

From 1995 to 2002, there were 1–5 cases of *M. bovis* BCG diagnosed in children under 15 years of age each year. In 2003, the number of cases rose to 30, and in the subsequent years the figure remained high compared with previous years (13 cases in 2004 and 23 cases in 2005).

M. bovis BCG bacterial strain is a strain attenuated from the *M. bovis* bacterial species belonging to the *M. tuberculosis* complex. It is used in BCG vaccinations for newborn babies to prevent severe forms of tuberculosis in infants. The attenuated strain cannot cause tuberculosis. As of 1 September 2006, BCG vaccinations are administered only to newborn children with an increased risk of tuberculosis. The decision to target the vaccinations to risk groups was made because tuberculosis has become rare in Finland and adverse effects associated with BCG vaccinations increased in 2003–2005.

The Department of Vaccines monitors clinical adverse effects of vaccinations, which together with the reporting of *M. bovis* BCG findings, as notified by the laboratories, forms an exceptionally efficient surveillance system.

7 ANTIMICROBIAL RESISTANCE

MRSA

In 2006, the situation with the methicillin-resistant *Staphylococcus aureus* (MRSA) remained the same. Less than 1,400 cases of MRSA were notified to the National Infectious Diseases Register (1,368 cases in 2005). There were 36 MRSA findings isolated from blood (27 findings in 2005 and 32 in 2004) and no findings in cerebrospinal fluid. Fifteen MRSA findings in blood were detected in the Helsinki and Uusimaa hospital district and eight in Pirkanmaa. However, the incidence in proportion to population was higher in the latter district (1.0 vs. 1.7/100,000) (Figure 11a and 11b).

As earlier, the hospital districts of Helsinki and Uusimaa, Pirkanmaa and Pohjois-Pohjanmaa reported the highest numbers of cases. However, the incidence per 100,000 inhabitants was highest in the hospital districts of Pirkanmaa, Etelä-Savo and Etelä-Karjala. As earlier, the majority of findings were detected in patients who were 70 years of age or older. The proportion of MRSA-infected children was small, less than 5%, and the number of cases in children did not increase from the previous year.

The KTL Laboratory of Hospital Bacteriology confirms and types all MRSA strains in Finland. In 2006, the total number of tested strains was about 1,450, which is slightly less than in 2005. Approximately 30 per cent of the confirmed MRSA cases were still caused by one multiply resistant epidemic strain (FIN-16), which has been causing problems for years. Other epidemic strains observed in previous years (FIN-4, FIN-7 and FIN-10 clones) were also common in many hospital districts. The number of infections caused by the second most common strain in 2005 (FIN-21) fell to half in 2006 (146 cases, 10% of all cases). Among the 15 most common MRSA strains were two Panton-Valentine leukocidin producing MRSA strains (FIN-25 and FIN-11). FIN-16 and FIN-21 together caused about half of the MRSA findings in blood (Table 7).

Figure 11 a. MRSA cases by hospital district 1995-2006

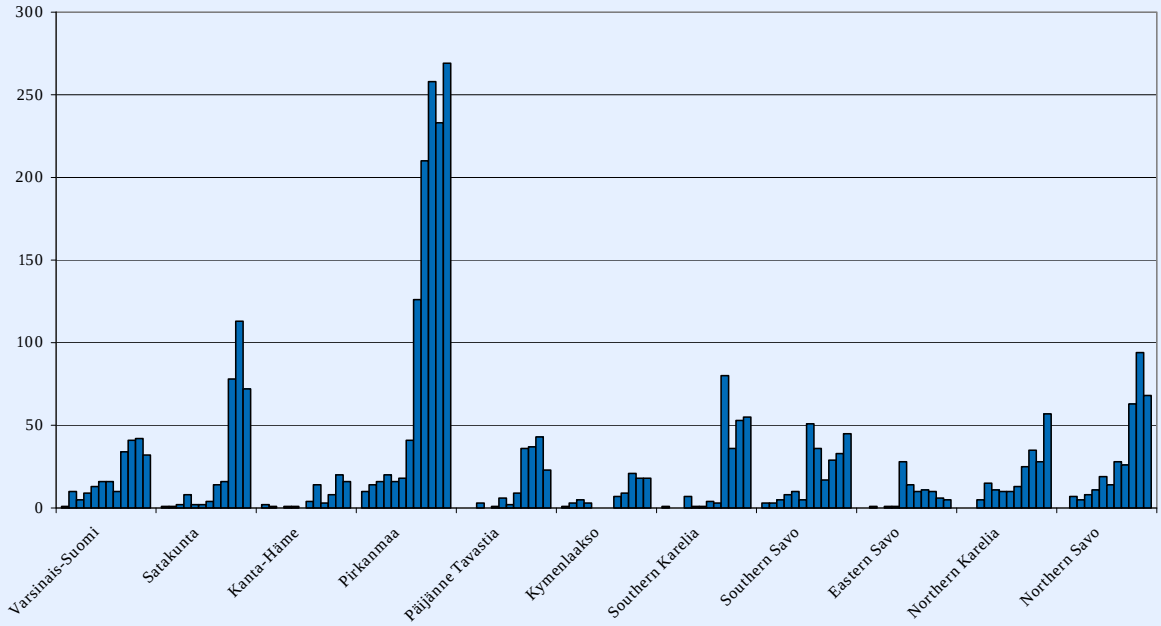


Figure 11 b. MRSA cases by hospital district 1995-2006

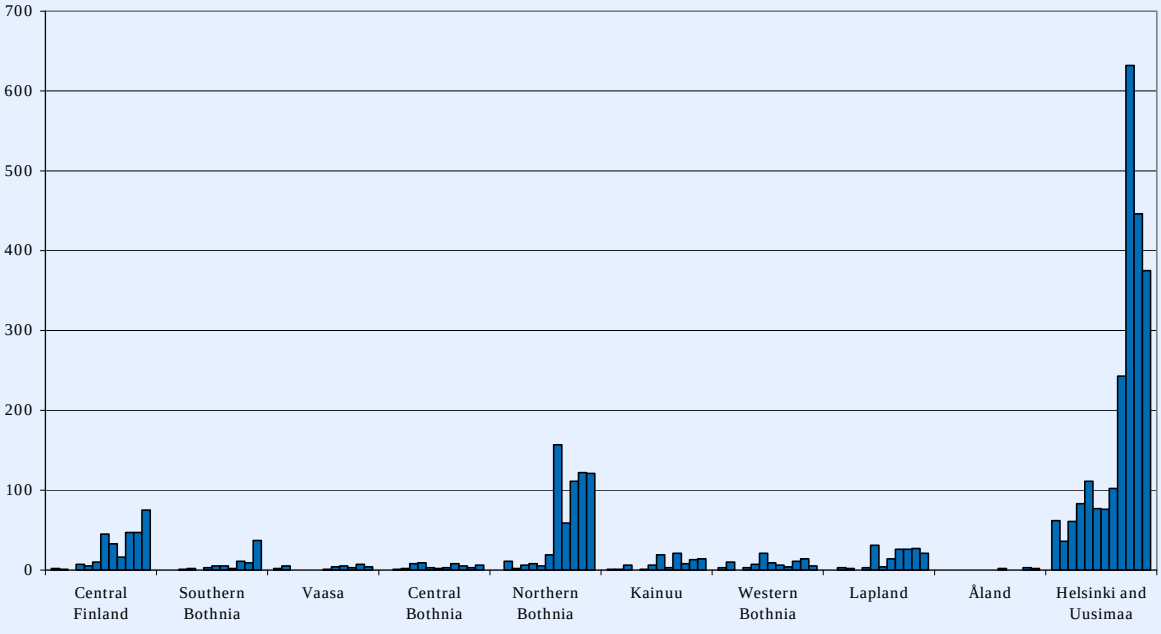


Table 7. MRSA-findings and their proportion of *Staphylococcus aureus* blood culture findings in 1995-2006

Year	All MRSA-findings	*S. aureus* –findings from blood	MRSA-findings in blood an their proportion of all *S. aureus* findings from blood (%)
1995	89	627	2 (0,3)
1996	108	667	0 (0)
1997	120	747	4 (0,5)
1998	189	717	5 (0,7)
1999	211	812	8 (1,0)
2000	261	849	4 (0,5)
2001	340	887	4 (0,5)
2002	599	988	10 (0,9)
2003	851	978	7 (0,7)
2004	1460	1057	32 (2,9)
2005	1368	1013	27 (2,7)
2006	1317	1239	36 (2,9)
Yhteensä	**6913**	**10581**	**139 (1,3)**

VRE

In 2006, the number of vancomycin-resistant eneterococcal (VRE) findings notified to the National Infectious Diseases Register fell to half from the previous year. The majority of findings were detected in the Helsinki and Uusimaa hospital district. The frequency of findings was highest early in the year, and most of the cases were 70 years of age or older. In other hospital districts (n=4) the number of findings varied from one to six. Two VRE findings were from blood and none from cerebrospinal fluid.

In 2006, the KTL Laboratory of Hospital Bacteriology confirmed a total of 30 new VRE findings in 28 persons by bacterial typing. A new outbreak caused by an *Enterococcus faecium* species *van*B type VRE strain (VRE VII) was detected in the Helsinki and Uusimaa hospital district; one of the findings was in blood. In Pohjois-Pohjanmaa there were a few VRE II and V cases, the rest of the detected seven VRE findings were different from each other.

Invasive pneumococcal disease – antimicrobial susceptibility of Pneumococcus

The incidence of invasive pneumococcal disease has remained the same in recent years. In 2006, there were 741 notified cases (14/100,000).

In 2006, the KTL Antimicrobial Research Laboratory analysed the antimicrobial susceptibility of 760 pneumococcal strains isolated from invasive infections. Compared with the year 2005, the proportion of strains with reduced susceptibility to penicillin (MIC≥ 0.125 µg/ml) has nearly doubled (16.4%). The proportion of resistant strains (MIC ≥ 2 µg/ml) was 4.2 per cent, and 12.2 per cent of the strains had reduced susceptibility (I, intermediate). The proportion of macrolide resistant strains continued to increase; 23.4 per cent of invasive pneumococcal strains were resistant to erythromycin. The proportion of multiply resistant (PEN-ERY-TET) strains in 2006 was 5.4 per cent. Resistance to fluoroquinolones or ceftriaxone is still rare (Table 8).

Table 8. Antimicrobial resistance of *Streptococcus pneumoniae* findings in blood and CSF 1998-2006

Year	Cases reported to the National Infectious Diseases Register	Examined strains	Erythromycin (%)	Penicillin (I+R) (%)	Multidrug resistance (%)
1998	561	84	3,6	0	0
1999	568	471	5,9	7,2	0
2000	601	439	8	3,7	1,4
2001	658	360	18,8	7,5	5
2002	599	594	16,3	8	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	23,4	16,4	5,4

I - reduced susceptibility; R - resistant; Multidrug resistance - strains simultaneously resistant to penicillin, erythromycin and tetracycli

8 OTHER INFECTIONS

Haemophilus *(Haemophilus influenzae)*

In 2006, there were 32 notifications on *Haemophilus influenzae* in blood or cerebrospinal fluid. *Haemophilus influenzae* type b caused disease in one adult and in one child under 15 years of age. The child had received Hib vaccine in accordance with the vaccination programme. Children born in 1985 or later have received Hib vaccine since 1986 at the healthy child clinic. Since the beginning of 2005, according to the revised vaccination programme, Hib vaccination is administered as a component of a combination vaccine at the age of three, five and twelve months.

The efficiency of the vaccination is monitored, and vaccination data are collected for all children who have been diagnosed with Hib disease.

Meningococcus (*Neisseria meningitidis*)

There were 46 meningococcal infections detected in blood or cerebrospinal fluid, which is similar to previous years' figures. The serogroup distribution was similar as previously. The majority of infections were caused by group B meningococcus. There was one group Y strain and five group C strains. In three cases the serogroup could not be determined, in one case the strain was not submitted to more detailed analysis. Eight cases were 0–4 years old and fourteen were 15–19 years of age.

In February–March, three 20–25-year-olds in Helsinki and Espoo contracted group B meningococcal infection. The typing results indicated that all were of different subtypes. In September–October, two under 12-month-olds and one 3-year-old child in day care contracted a meningococcal infection in the same cities.

The patients under 12 months of age had an infection caused by an unspecified group B meningococcus, and a group C meningococcus caused the infection in the 3-year-old (Table 9).

Table 9. Meningococcal infections by serogroup 1995-2006

Year	Group A	Group B	Group C	Group Y	Group W135	Unknown	Total
1995	-	50	22	-	-	6	78
1996	-	59	15	3	-	2	79
1997	-	36	5	3	-	2	46
1998	-	44	7	2	-	1	54
1999	-	35	9	8	1	5	58
2000	-	30	11	2	3	2	48
2001	-	34	9	4	1	3	51
2002	-	36	6	4	1	2	49
2003	-	28	5	6	-	2	41
2004	-	28	5	5	2	4	44
2005	-	33	1	3	-	3	40
2006	-	34	4	1	-	7	46

MPR diseases (Morbilli, Parotitis epidemica, Rubella)

Not a single case of measles was notified in 2006. One adult contracted rubella. Eight cases of mumps were notified. Five mumps cases were under 20 years of age and the rest were adults. Measles, mumps and rubella (the MPR diseases) are typical children's diseases caused by viruses. Their prevention in Finland was initiated by launching the MPR vaccination programme in 1982. As a result of the programme, cases of domestic transmission have not been detected in Finland since mid-1990s. The few diagnosed infections have been acquired when travelling abroad.

Puumala virus

In 2006, nearly 1,900 cases of Puumala virus were reported, which is 25 per cent less than in 2005. Many cases were diagnosed around New Year 2005–2006. After the high number of cases in early winter, the situation typically calmed down by April–May. The frequency of epidemic nephropathy caused by Puumala virus is generally highest in November–December. This was the pattern in 2004 and 2005. These years were followed by a more quiet period in 2006, with the number of cases in November–December (396) falling to half from the previous year. This is in line with the three-year cyclical variation of the bank vole population and epidemic nephropathy.

In 2006, the highest incidence was in the Lappi hospital district, 153/100,000. In the typical top incidence regions the figures were slightly lower, 120/100,000 in Etelä-Savo and 114/100,000 in Itä-Savo. Nearly half of all the cases were diagnosed in 40–59-year-olds. Sixty per cent of all cases with epidemic nephropathy were in men (Figure 12).

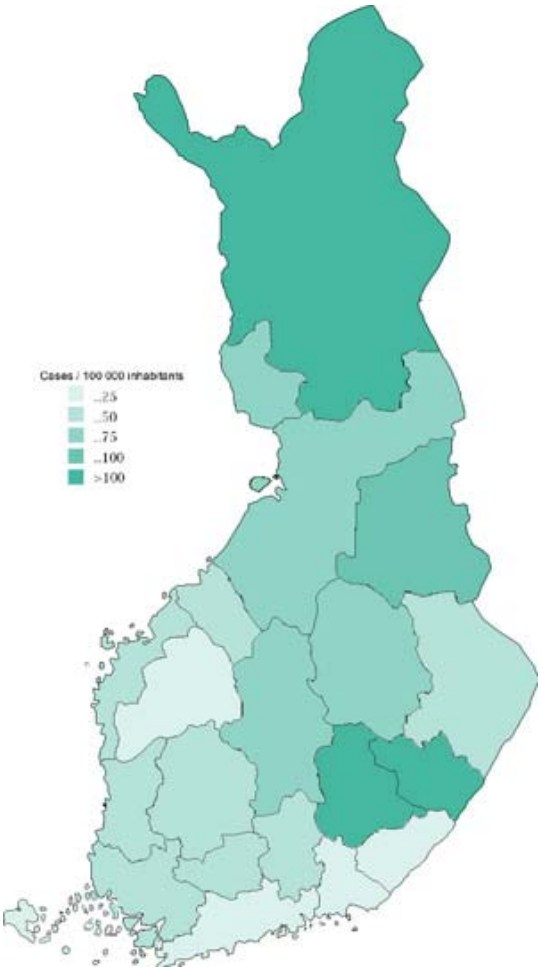


Figure 12. Average incidence of Puumala virus cases by hospital district 2006.

Tick-born encephalitis virus

There were 17 notified cases in 2006, which is about the same as in 2005. Most TBE cases were detected between July and October. Compared with previous years it was exceptional that three cases were diagnosed in Åland and seven at the coast. An unexpected finding were four cases in Lappeenranta area in the Etelä-Karjala hospital district. The number of cases of tick-born encephalitis (TBE) began to rise in the 1990s nearly everywhere in the Baltic Sea region, also in Finland. The development is believed to be a result of climate change, which has facilitated the circulation of the virus in tick populations.

In Finland the disease has been typical for Åland, and sporadic cases have also been diagnosed at the south, southwest and west coast of Finland. The record year was 2000 with 41 cases. Traditionally, about half of the cases have been diagnosed on Åland. An efficient vaccine is available for the disease. Åland included the vaccine in its vaccination programme in 2006. All local residents over 7 years of age are vaccinated against TBE.

Tularemia (*Francisella tularensis*)

In 2006, the National Infectious Diseases Register received notifications on 475 (9/100,000) cases of microbiologically confirmed tularemia. The high incidence was due to a tularemia outbreak; normally some 100 cases (1–2/100,000) are reported each year. In 2006, fifty-seven per cent of the patients were men. Cases were in all age groups, most frequently in 35–65-year-olds. The majority of cases were diagnosed between July and October. Cases were diagnosed in the known endemic regions in the hospital districts of Keski-Suomi, Etelä-Pohjanmaa and Pohjois-Pohjanmaa, and now also in the hospital districts of Satakunta, Pirkanmaa and Helsinki and Uusimaa. Extensive tularemia outbreaks have also occurred in 1995, 1996, 2000 and 2003. Tularemia spreads mainly via insect bites. When the infection is transmitted from an insect to a human, the site of the bite becomes a red, swollen and painful nodule which develops into an ulcer. The infection spreads into local lymph glands (ulcero-glandular form).

Pogosta disease

In 2006 there were 21 cases of Pogosta disease, caused by the sindbis virus. The figure was the lowest in National Infectious Diseases Register surveillance history. Half of the cases were reported in the province of Eastern Finland in August–September. Extensive Pogosta disease outbreaks occur in Finland with seven year intervals, the last was one in 2002.

Borrelia

The total number of borrelia cases was 1,137, which is about the same as in previous years. In 2006, the highest incidence was again in Åland, which accounted for some 35 per cent of all diagnosed borrelia infections in Finland, with 403 cases (1,505/100,000 inhabitants). Like in previous years, the frequency of borrelia was highest in autumn, from August to November. Nearly three quarters (72%) of the cases were diagnosed in over 45-year-olds (Figure 13).

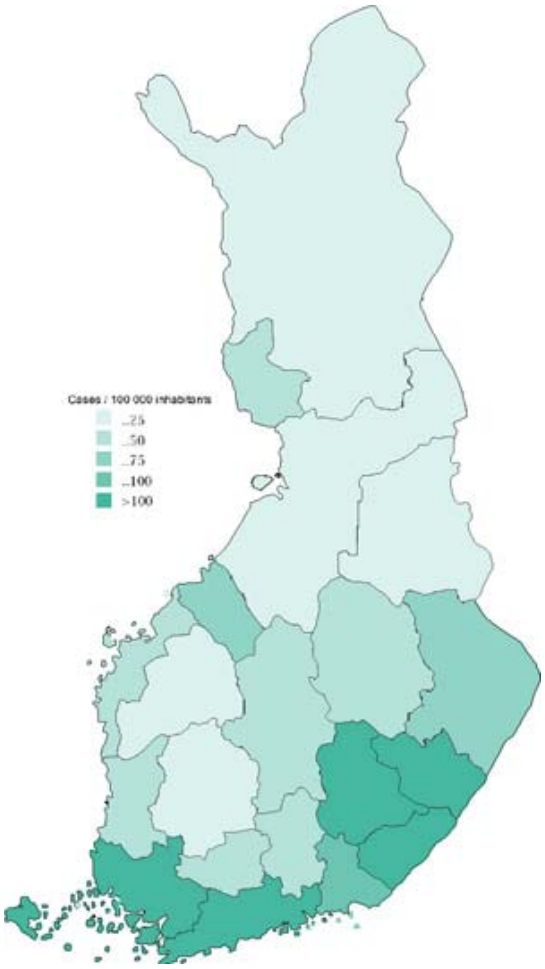


Figure 13. Average incidence of borrelia cases by hospital district 2006

Malaria

In 2006, 30 cases of malaria were diagnosed in Finland. There were 20 cases of *Plasmodium falciparum*, six *P. vivax*, one *P. ovale* and two *P. malariae* infection. In one case the malaria species was unidentifiable.

Compared with previous years, the number of malaria cases, countries of acquisition and risk groups have remained approximately the same. One or two vivax malaria cases have usually been brought from India each year, but now the number was higher than before.

The majority of cases, 24 (80%), including all falciparum, ovale and malariae malarias, were from Africa. All *P. vivax* infections came from India.

Seventeen of the cases were Finns and thirteen were foreigners. Twenty-four were permanent residents of Finland. Fourteen cases had been on a short trip of less than six months in a malaria region, and one was a Finn residing in a malaria region. Ten cases had visited their former home in a malaria region. Three were immigrants who became ill immediately after arriving in Finland. Two cases were visiting Finland.

The majority of the 28 cases had taken no malaria prophylaxis or had taken it irregularly (Table 10).

Table 10. Malaria cases detected in Finland in 2006 by coutry of acquisition

Continent	Country	Cases
Asia	India	6
	Total	**6**
Africa	Cameroon	4
	Congo	3
	Kenya	2
	Uganda	2
	Gambia	2
	Malawi	2
	Mozambique	2
	Togo	1
	Tanzania	1
	Sierra Leone	1
	Nigeria	1
	Ivory Coast	1
	Zambia	1
	Total	**23**
South America	Brazil	1
	Total	**1**
Unknown		1
	Total	**31**

9 FINDINGS IN BLOOD AND CEREBROSPINAL FLUID

Blood culture findings in children

In 2006, the number of blood culture positive cases in children under 15 years of age was similar to the previous year, with slightly under 700 notified cases. Children under 12 months of age constituted about 60 per cent of the findings.

Among children under 12 months of age, *Staphylococcus epidermidis* and other coagulase-negative staphylococci caused about 40 per cent of blood culture positive infections. These infections are typical in newborn babies in intensive care. Usually the onset is after 7 days of life, classified as late-onset sepsis. The second most common finding was *Streptococcus agalactiae* (group B streptococcus, GBS). Typically, it is acquired from the mother's birth canal during labour, causing the newborn an early-onset sepsis. Other common causes of infection were *Eschericia coli*, *Staphylococcus aureus* and *Streptococcus pneumoniae* One *S. aureus* infection was caused by a methicillin resistant strain.

S. pneumoniae was the most common finding in 1–14-year-olds, covering a third of notified cases in this age group. The next most common findings were coagulase-negative staphylococci, *S. aureus* and *E. coli.* No resistant *S. aureus* strains were detected among the notified cases.

Coagulase-negative staphylococci caused nearly a third of all cases diagnosed in children, the situation being similar since 2001. Intensive care and related interventions, particularly foreign bodies like central venous catheters that remain in the body for a prolonged time, often constitute a predisposing factor for infections caused by these bacteria. Compared with recent years, there were no significant changes in children's blood findings. Fungi constituted only about one per cent of the findings (Tables 11 and 12).

Table 11. Blood culture findings 1995-2006, infants (under 1 year of age)

Microbe / microbial group	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Staphylococcus, other than aureus	54	56	59	64	86	76	100	117	85	155	133	146
Streptococcus, beta-haemolytic	49	50	44	54	44	40	43	48	39	50	73	56
Escherichia coli	52	38	40	48	39	43	39	40	39	37	41	44
Staphylococcus aureus	27	22	22	33	29	17	17	24	21	32	32	37
Streptococcus pneumoniae	21	11	14	17	16	28	15	12	23	28	26	25
Enterococci	15	15	9	12	8	8	7	13	13	13	17	25
Enterobacter species	9	5	7	7	10	6	6	6	6	5	3	13
Streptococcus viridans and milleri groups	11	10	9	6	13	7	11	9	12	15	11	11
Klebsiella species	5	12	8	8	10	9	8	7	8	9	9	8
Acinetobacter species	4	1	1	3	2	1		4	3	1	1	3
other bacteria	16	20	12	27	27	31	19	21	19	25	15	19
Bacteria, total	**263**	**240**	**225**	**279**	**284**	**266**	**265**	**301**	**268**	**370**	**361**	**387**
Fungi	**6**	**4**	**1**	**3**	**16**	**12**	**11**	**18**	**4**	**3**	**5**	**4**
Total number of cases	**269**	**244**	**226**	**282**	**300**	**278**	**276**	**319**	**272**	**373**	**366**	**391**

Table 12. Blood culture findings 1995-2006, children (1-14 years)

Microbe / microbial group	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Streptococcus pneumoniae	71	87	74	60	61	72	76	87	89	88	101	99
Staphylococcus, other than aureus	61	36	43	38	55	65	44	57	48	41	59	49
Staphylococcus aureus	44	35	54	48	57	42	35	58	47	58	41	37
Streptococcus viridans and milleri groups	23	25	27	26	20	20	23	14	12	18	27	24
Escherichia coli	11	11	19	13	14	20	5	13	13	15	10	16
Streptococcus, beta-haemolytic	4	10	3	11	12	11	10	10	17	7	2	13
Neisseria meningitidis	3	11	8	9	12	9	9	8	6	2	7	6
Bacillus	3	5	4	1	4	9	2	5	6	2	7	6
Pseudomonas aeruginosa	3	4	4	7	1	6	7	4	6	3	6	3
Fusobacterium species	1	6	4	2	5	4	1	3		1	2	3
other bacteria	37	36	49	42	49	38	36	45	40	38	57	37
Bacteria, total	**261**	**266**	**289**	**257**	**290**	**296**	**248**	**304**	**284**	**273**	**319**	**293**
Fungi	**9**	**3**	**6**	**3**	**7**	**5**	**1**	**3**	**3**	**1**	**1**	**5**
Total number of cases	**270**	**269**	**295**	**260**	**297**	**301**	**249**	**307**	**287**	**274**	**320**	**298**

CSF findings in children

The number of bacterial and fungal findings from children's central nervous system infections has remained at a very stable level since 1995. Some 35–37 cases have been notified each year, with about half of the cases being diagnosed in children under 12 months of age. In 2006, there were 37 notified cases diagnosed in under 15-year-olds.

In children under 12 months of age, the most common finding was *S. agalactiae* (GBS) with seven cases. Meningitides due to GBS in newborn babies are usually late-onset sepses; only in about half of the cases the mother has been found to carry GBS. In other cases the source of infection has remained unknown. The next most common findings were *S. epidermidis* and enterococcus, both with three notified cases. In 2006, meningococcus was found in the cerebrospinal fluid of one child under 12 months of age.

Meningococcus was the most common finding in 1–14-year olds, constituting about 40 per cent of the findings in this age group. Pneumococcus was notified in five cases. Other findings were sporadic, as has been the case in recent years. Exceptionally, there were no notified cases of infections caused by coagulase-negative staphylococcus. Normally there have been several findings each year (Tables 13 and 14).

Table 13. Cerebrospinal fluid culture findings, infants (under 1 year of age)

Microbe / microbial group	2002	2003	2004	2005	2006
Streptococcus agalactiae	5	1	10	7	7
Staphylococcus, other than aureus	10	4	5	4	3
Enterococci	-	1	1	-	3
Escherichia coli	1	1	2	-	2
Streptococcus pneumoniae	3	6	8	3	1
Other bacteria	4	8	11	2	3
Bacteria total	23	21	37	16	19
Fungi	-	-	-	-	-
Total number of cases	23	21	37	16	19

Table 14. Cerebrospinal fluid culture findings, children (1–14 years)

Microbe / microbial group	2002	2003	2004	2005	2006
Neisseria meningitidis	7	4	4	5	7
Streptococcus pneumoniae	1	7	2	1	5
Streptococcus viridans group	-	1	1	-	2
Escherichia coli	-	-	-	-	1
Bacteroides fragilis group	-	-	-	-	1
Other bacteria	21	10	12	13	2
Bacteria total	29	22	19	19	18
Fungi	-	-	1	-	-
Total number of cases	29	22	20	19	18

Blood culture findings in adults

The total number of blood culture positive cases in adults has grown steadily in recent years. In 2006, there were nearly 9,000 diagnosed cases. Gram-positive bacteria are still more common in the working-age population (15–64-year-olds) and gram-negative in

patients aged 65 years or more. Anaerobic bacteria constituted nearly five per cent and fungi about two per cent of all cases with blood culture findings.

In the working-age population, the most common bacterial finding was *Eschericia coli*, constituting about twenty per cent of all cases. The next most common were *Staphylococcus aureus*, coagulase-negative staphylococci and *Streptococcus pneumoniae.*

E. coli was also the most common blood culture finding among cases aged 65 years or more, representing nearly a third of all cases. The next most common bacterial causes in this age group were *S. aureus*, coagulase-negative staphylococci, Klebsiella species and *Streptococcus pneumoniae*.

Betahaemolytic streptococcal findings were still on the rise. The number of cases doubled from 1995 to 2004. Increase was now detected particularly in group A streptococci (*Streptococcus pyogenes)* among the working-age population. Since 1995, the number of

blood culture confirmed pneumococcal infections has been on the rise among the elderly, and in 2006 the number of cases reached a new record (269) (Tables 15 and 16).

Table 15. Blood culture findings 1995-2006, working-age population (15-64 years)

Microbe / microbial group	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Escherichia coli	407	423	498	495	547	532	613	580	645	707	780	797
Staphylococcus aureus	279	288	348	340	389	394	437	457	445	486	457	564
Staphylococcus, other than aureus	265	311	293	342	359	413	421	461	421	436	411	419
Streptococcus pneumoniae	221	251	293	283	298	308	342	312	381	387	375	345
Streptococcus, beta-haemolytic	119	123	166	177	205	206	202	249	225	259	271	308
Streptococcus viridans and milleri groups	116	137	140	149	168	171	166	166	174	198	196	191
Enterococci	81	105	121	112	117	111	164	165	145	136	178	158
Klebsiella species	92	93	113	106	114	115	114	134	121	159	184	145
Bacteroides fragilis group	60	51	62	65	73	69	64	61	59	67	83	85
Enterobacter species	55	65	78	76	58	75	92	53	60	62	49	77
other bacteria	429	396	393	427	430	449	469	402	436	440	520	486
Bacteria, total	**2124**	**2243**	**2505**	**2572**	**2758**	**2843**	**3084**	**3040**	**3112**	**3337**	**3504**	**3575**
Fungi	**32**	**49**	**54**	**62**	**58**	**56**	**71**	**54**	**80**	**71**	**66**	**80**
Total number of cases	**2156**	**2292**	**2559**	**2634**	**2816**	**2899**	**3155**	**3094**	**3192**	**3408**	**3570**	**3655**

Table 16. Blood culture findings 1995-2006, aged population (65 years and more)

Microbe / microbial group	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Escherichia coli	857	951	998	967	1012	1033	1178	1213	1314	1466	1623	1706
Staphylococcus aureus	277	322	322	296	337	397	398	449	466	483	483	601
Staphylococcus, other than aureus	253	265	256	231	294	372	388	379	370	399	413	401
Enterococci	145	145	140	168	169	210	224	215	241	305	273	329
Klebsiella species	143	155	161	177	167	201	241	230	252	342	339	326
Streptococcus, beta-haemolytic	91	136	159	150	170	162	194	195	213	241	258	302
Streptococcus pneumoniae	165	175	196	185	178	189	214	184	220	240	229	269
Streptococcus viridans and milleri groups	90	86	111	106	110	124	128	121	155	160	164	184
Pseudomonas aeruginosa	129	121	107	94	116	119	132	148	148	138	151	154
Bacteroides fragilis group	67	75	90	81	99	96	104	96	117	120	135	119
other bacteria	318	372	394	406	405	462	502	471	489	559	616	620
Bacteria, total	**2535**	**2803**	**2934**	**2861**	**3057**	**3365**	**3703**	**3701**	**3985**	**4453**	**4684**	**5011**
Fungi	**46**	**36**	**36**	**43**	**51**	**68**	**71**	**71**	**113**	**77**	**68**	**76**
Total number of cases	**2581**	**2839**	**2970**	**2904**	**3108**	**3433**	**3774**	**3772**	**4098**	**4530**	**4752**	**5087**

Among the working-age population, the number of cases caused by *Candida albicans* has tripled from 1995 to 2006.

CSF findings in adults

The number of cases with bacterial and fungal findings in adults doubled from 1995 to 2004. After this, the number has remained relatively stable.

The most common bacterial finding in working-age patients is still coagulase-negative staphylococcus. The number of cases involving actual pathogens has not changed much: the most common was meningococcus, followed by pneumococcus and *S. aureus.*

Coagulase-negative staphylococcus was also the most common culture finding in patients aged 65 years or more. It was followed by pneumococcus, *S. aureus* and *Listeria monocytogenes.* The number of pneumococcal findings in this age group has nearly doubled in the past ten years (Tables 17 and 18).

Table 17. Cerebrospinal fluid culture findings, working age population (15–64 years)

Microbe / microbial group	2002	2003	2004	2005	2006
Staphylococcus, other than aureus	46	32	46	50	45
Neisseria meningitidis	19	15	11	15	21
Streptococcus pneumoniae	11	21	21	15	17
Staphylococcus aureus	6	10	17	10	9
Pseudomonas aeruginosa	5	4	2	4	6
Other bacteria	42	27	36	46	49
Bacteria total	129	109	133	140	147
Fungi	2	1	6	2	3
Total number of cases	131	110	139	142	150

Table 18. Cerebrospinal fluid culture findings, aged population (65 years and more)

Microbe / microbial group	2002	2003	2004	2005	2006
Staphylococcus, other than aureus	13	11	13	17	12
Streptococcus pneumoniae	4	5	4	8	10
Staphylococcus aureus	2	7	7	5	3
Listeria monocytogenes	2	4	2	4	3
Enterococci	3	4	0	2	2
Other bacteria	19	15	12	11	12
Bacteria total	43	46	38	47	42
Fungi	2	-	1	1	2
Total number of cases	45	46	39	47	44

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