Publications of the National Public Health Institute KTL B13/2005

INFECTIOUS DISEASES IN FINLAND 1995–2004

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Editors: *Joonas Iivonen, Eija Kela, Markku Kuusi, Outi Lyytikäinen and Petri Ruutu*

The editors would like to thank all the contributors for their co-operation that resulted in an interesting review with a wide scope. We would also like to thank *Sinikka Mustonen* for checking the text at various stages, and *Eija-Liisa Mäkelä* for making many corrections.

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 updated after the figures have been published in print. Up-to-date figures are available at http://www.ktl.fi/ttr

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

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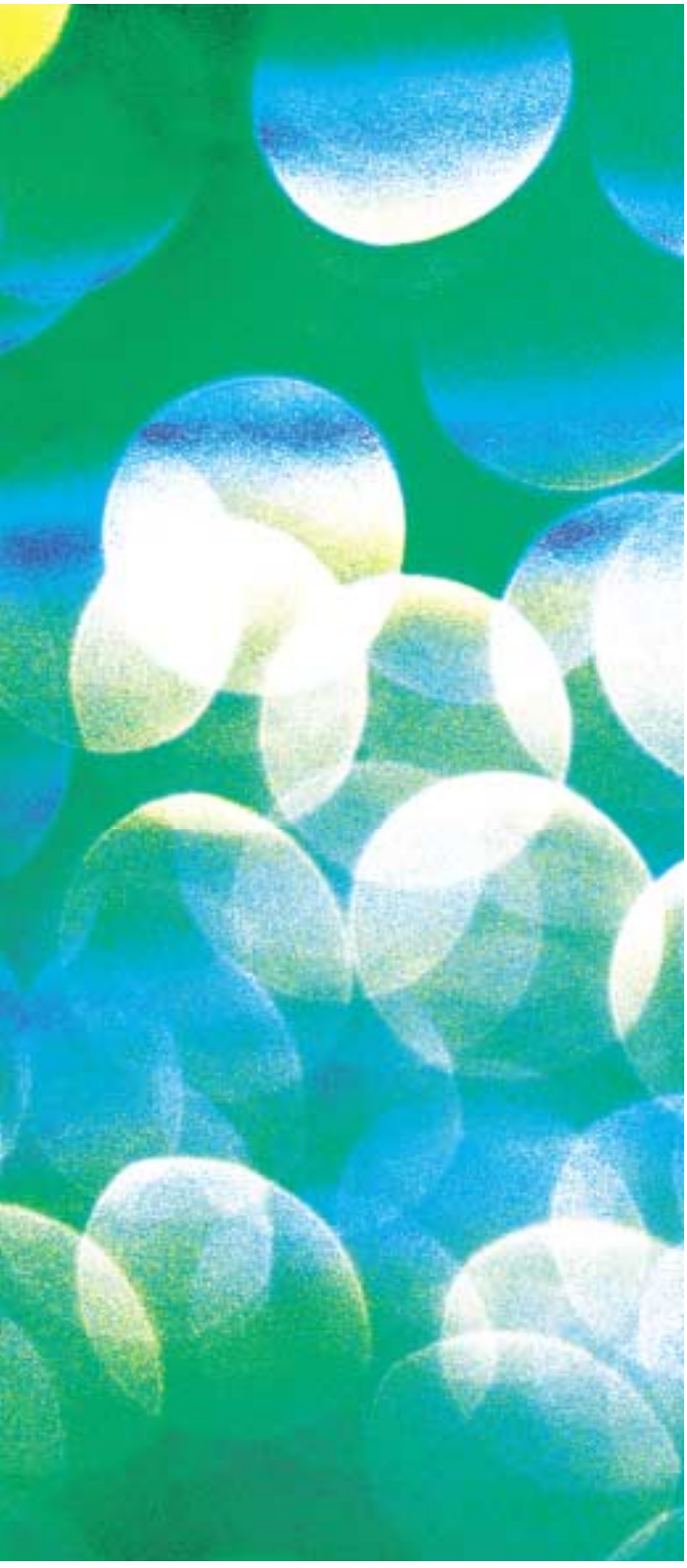

INTRODUCTION

Expanded electronic transfer of data in the National Infectious Diseases Register

The year 2004 was the tenth full year of operation for the National Infectious Diseases Register. When the register was established, its operating principles were advanced even by international standards: microbiological laboratories notify their findings directly to the national register, and are linked with the complementary data notified by the treating physicians for a number of diseases under surveillance.

The basic concepts regarding the operation of the register have proved efficient. Especially the Internet contributed to the development of electronic information management and data transfer methods. On the other hand, the information need of the personnel responsible for the regional and local surveillance and prevention of infectious diseases increased. This has rapidly changed the operating environment and requires continuous development.

As the operating environment has changed, the objective of the National Infectious Diseases Register has also shifted from the surveillance of long-term trends to supporting the rapid detection and control of regional epidemics. The changing objective requires rapid communication to the personnel responsible for infectious disease control in hospital districts and health centres. This has been enabled by increased direct electronic notifying from the microbiological laboratories to the National Infectious Diseases Register. The hospital districts (from the beginning of 2004 also the health centres) can use encrypted Internet connection for access to all data concerning their respective regions in the national register, and this has also speeded up the communication process. In the beginning of 2004, the operation of the National Infec-

tious Diseases Register's strain collection became statutory. The purpose of the strain collection is to obtain strains of important pathogens, for confirming identification and to perform various typings and susceptibility assays. These data are also available for those responsible for infectious disease control and prevention. As a whole, the system is unique internationally.

Improved quality of data

The range of infectious diseases under surveillance is wide, comprising approximately 70 diseases or pathogens and all microbial findings in blood and cerebrospinal fluid. Unique person identifying numbers have been employed in the entire National Infectious Diseases Register since the beginning of 2004. This ensures reliable linking of data obtained on the same case from different sources, as well as reliable geographical locating of cases with the help of the data available in the Population Information System. The use of the unique person identifying number enables versatile population-based research on a range of infectious diseases that is uniquely wide internationally, exploiting also Finland's other high-quality health care registers. Comprehensive statistical data recorded in the National Infectious Diseases Register are available to the public at http://www.ktl.fi/ttr.

As regards the quality of data in the National Infectious Diseases Register and the functioning of the system, immediate notification of findings by microbiological laboratories is critical, as is the work of the personnel responsible for infectious diseases in the hospital districts, who check and complete the physicians' notifications before they are submitted to the national register.

EPIDEMIOLOGICAL KEY EVENTS IN THE TEN-YEAR PERIOD

Vaccine-preventable diseases have decreased

Since the establishment of the National Infectious Diseases Register, three diseases have disappeared from Finland due to vaccinations. Endemic MMR cases (measles, mumps, rubella) have not been diagnosed since the mid-1990s. Only sporadic cases have been detected in nonvaccinated people, related to travelling. Diseases caused by *Haemophilus influenzae* type b (Hib) decreased rapidly due to Hib vaccinations started in 1986. There have been several years with no Hib cases being diagnosed in vaccinated age groups. The incidence of tuberculosis cases has halved during the last ten years, which is mainly due to the shrinking age groups that were born before World War II and are susceptible to the reactivation of tuberculosis.

New whooping cough vaccine

The incidence of whooping cough, a vaccine-preventable disease, has increased. In 2004, the incidence was clearly the highest in the surveillance period, which has caused concern over the efficacy of the vaccination programme. A whooping cough vaccine booster was added to the vaccination programme in 2003, administered right before the child starts school. Since the beginning of 2005, a cell-free whooping cough vaccine has been in use as a component in a new combination vaccine.

Effective preventive measures against drug abuse

Acute hepatitis B cases, new hepatitis C cases and HIV cases related to injecting drugs have started to decrease. This supports the perception that the

preventive measures to decrease drug abuse and particularly to reduce the harm from infections related to drugs have been efficient. Low-threshold counselling centres for the exchange of needles and syringes have been established in different parts of Finland. In 2002–2003, there was a large outbreak of hepatitis A in different parts of Finland, mainly among injecting drug users. The extensive targeted vaccination programme that was executed then evidently had a central role in suppressing the outbreak.

Chlamydia still the most common sexually transmitted disease among the young

Sexually transmitted Chlamydia infection, clearly the most common disease in the Infectious Diseases Register by the number of cases (more than 13,000 cases a year; about a quarter of all notified cases in the register) has continued to increase until recent years. Now the situation may be stabilising. Chlamydia infections often have chronic consequences, which renders the disease a massive challenge to public health work.

Reinforcing the communication in outbreak investigations

During the last ten years much effort has been put into reinforcing communication during outbreaks and into strengthening investigation. Several campylobacter outbreaks transmitted via water distribution systems occurred before the 2000s. Since the latter half of the 1990s Yersinia has become a major cause of outbreaks. In various outbreak investigations fresh produce, like iceberg lettuce or grated carrot, has been identified as the vehicle. New guidelines have been provided recently aiming to prevent such cases.

Increasing MRSA outbreaks

Finland's antimicrobial susceptibility situation was internationally favourable until the beginning of the 2000s. Recurrent MRSA epidemics have changed the situation in recent years. During the last two years, the percentage of MRSA strains in *Staphylococcus aureus* findings from blood has increased rapidly. The macrolide resistance of pneumococcal strains detected in blood and cerebrospinal fluid has increased rapidly in a few years, and the percentage of strains with reduced susceptibility to penicillin is also considerable. This unfavourable development requires efficient measures focussing on more restricted use of antimicrobials and reinforcing the prevention of hospital infections, in order to reverse the negative trend before it is too late.

Helsinki 10 June 2005

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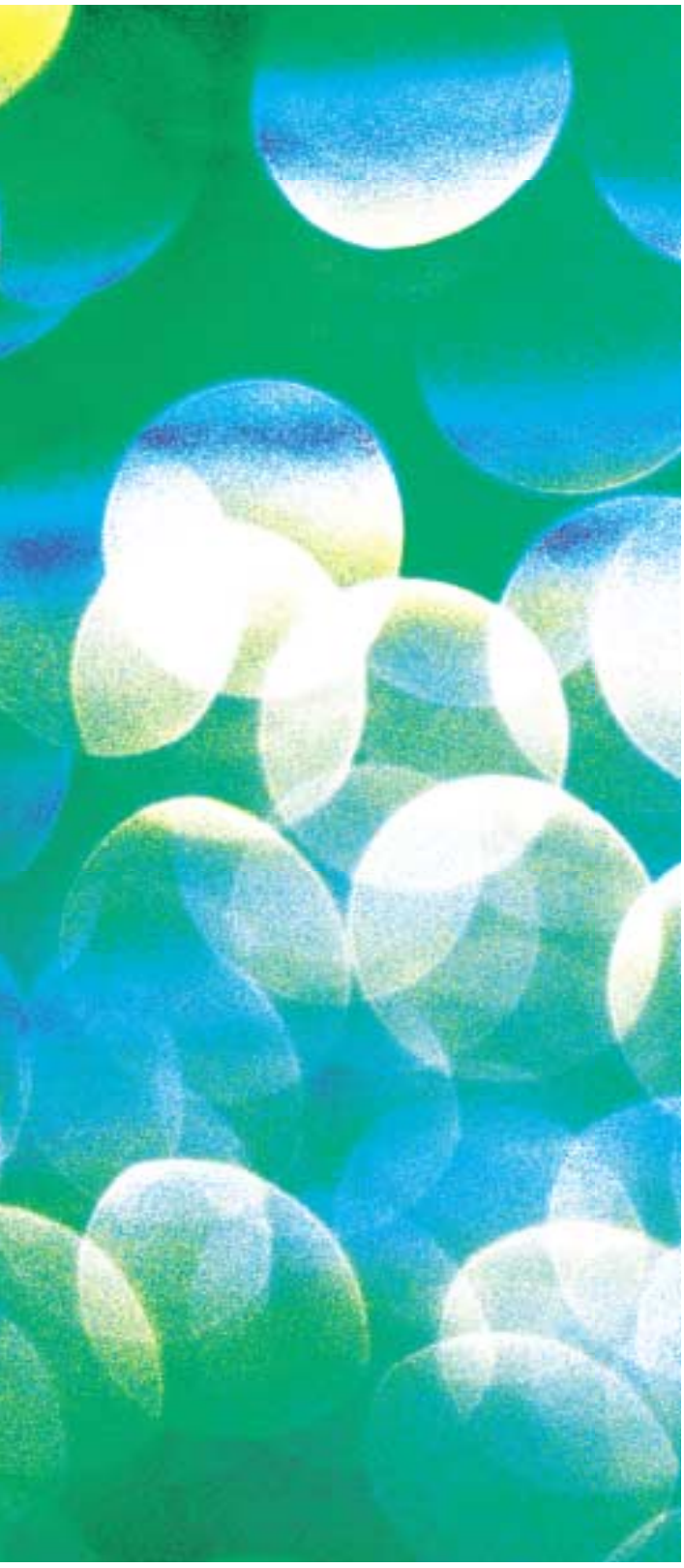


RESPIRATORY INFECTIONS

INFLUENZA A AND B – YEAR 2004

Influenza A broke out exceptionally early, in November 2003, and peaked in December. The epidemic began to subside rapidly in January 2004 and was practically over in February. An equally early influenza A outbreak was observed in Finland most recently in winter 1993/94. In 2003/04 the epidemic was caused by a Fujian/411/02 type virus. Toward the end of the epidemic, in February 2004 during a local outbreak in two garrisons, a Fujian virus variant was isolated with molecular changes and antigenic characteristics suggesting that this virus might cause an epidemic the following winter. The return of these Wellington/1/2004 type viruses to Finland was confirmed for the first time in December 2004.

In 2004, only sporadic influenza B infections were detected. No virus strains were isolated for further investigations.

Influenza A – epidemics in 1995–2004

Epidemics were reported every winter during the surveillance period. In eight winters the epidemic was caused almost solely by an H3N2 subtype virus, in one winter by an H1N1 subtype virus (2000/2001). In two winters (1995/1996 and 2002/2003) both subtypes caused an epidemic. In the latter of these winters an H1N2 subtype reassortant virus also appeared as epidemic. Mixed epidemics were dominated by the H3N2 subtype virus. The recurrence of H3N2 epidemics nearly every year is explained by their more rapid variation compared with the H1N1 viruses. The intensity and time of the outbreaks and the target population depend to a great extent on the appearance of new virus variants that can break through the population's immunity, and on the ca-

pability of these variants to replace their predecessors.

The number of cases in the National Infectious Diseases Register provide a reliable picture of the timing of the epidemics. The picture of the differences in outbreak intensity and target population is less accurate. In addition to the epidemiological situation, the number of cases is also affected by the amount of virological diagnostics. It has increased during the surveillance period, but it has focused differently on different age groups in different years.

A/H3N2 subtype: Even prior to the surveillance period discussed here, a new variant of the H3N2 virus has not always been able to cause an extensive epidemic during its first winter. This may have been the case also in winters 1994/95–1995/96 (Figure 1), when the epidemics were caused by the same new variant that differed from the reference virus (Shangdong/9/93) both genetically and by its antigenic characteristics. The first epidemic caused by Wuhan/395/95 type viruses in winter 1996/97 was less intensive than the epidemic of the following winter, during which new Sydney/5/97 type viruses gradually replaced the Wuhan virus. During the subsequent winters, Sydney type viruses developed several new branches in the H3N2 virus family tree, some of which also found their way to Finland. In winter 1998/99 the intensity of the epidemic was increased, for example, by viruses of the Moscow/10/99 branch and in winter 1999/2000 by viruses of the Panama/2007/99 branch. Winter 2000/01, with no H3N2 epidemic in Finland, facilitated the return of the Panama branch viruses in winter 2001/02. The Fujian/411/02 type H3N2 virus of the epidemic season 2002/03 was radically different from the Panama virus. Still, there was no major epidemic. A more extensive epidemic was observed the following winter when the Fujian viruses returned.

The peak of the findings during the H3N2 epidemics fell usually on January or February. Peaks in March 2002 and 2003 and a peak in December 2003 were exceptions. The late outbreak in 2002 was related to the return of the Panama branch viruses after skipping a year. The late outbreak in early spring 2003 was related to the spreading of a new Fujian type virus. A new Syd-

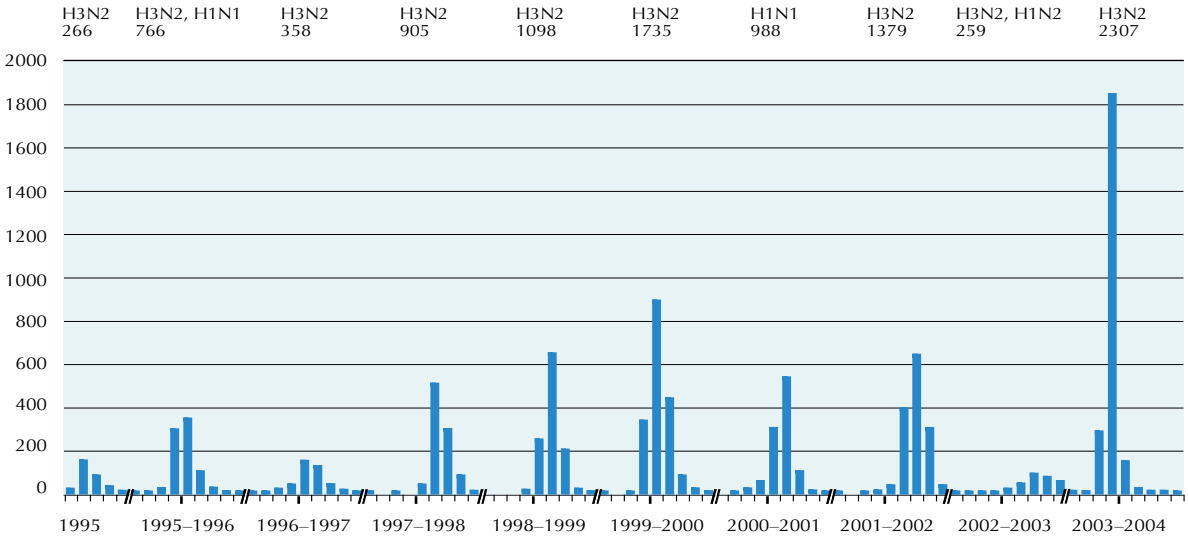


Figure 1. Influenza A cases by month 1995–2004. The subtypes of viruses and the total number of cases are provided by epidemic season (September-May).

ney type virus also spread late as it replaced a Wuhan type virus from an earlier epidemic period in 1998. The early outbreak in 2003 may be explained by Fujian type viruses remaining in Europe over the summer. In June-August 2003 eighteen influenza A findings were notified to the National Infectious Diseases Register, which is an exceptionally high number (only 1–6 cases were notified in other summers). Before this Finland had experienced an equally early H3N2 epidemic in autumn 1993. That time, too, the molecular epidemiology of the virus indicated that the virus might have remained in Europe over the summer.

A/H1N1 and A/H1N2 subtypes: The H1N1 virus of the mixed epidemic in winter 1995/96 was a new Bayern/7/95 type variant of the Singapore/6/86 type viruses used in vaccines for a long time. Only slightly varying, the virus was isolated in Finland from one patient in connection with the H3N2 epidemic as late as in winter 1997/98. The epidemic H1N1 virus of winter 2000/01 was a highly divergent New Caledonia/20/99 type variant that was isolated sporadically also in winter 2001/02 and as epidemic in winter 2002/03. The H1N2 reassortants in winter 2002/03 were also antigenically similar to the New Caledonia virus. H1N1 viruses have usually been described as attacking mainly children and young adults. The proportion of patients aged 65 years or more among the H1N1 findings notified to the Infectious Diseases Register in winter 2000/01 was only 1.9 percent. The proportion in epidemics that were caused by H3N2 viruses only and fall entirely within the surveillance period (n=6) was 19.7 percent (weighted average), being highest in winter 1999/2000 (32.7%).

Influenza B epidemics

Compared with influenza A findings, the numbers of cases with influenza B findings (Figure 2) indicate minor outbreaks and sporadic cases, with the exception of a large epidemic in winter 2002/03. During the surveillance period, antigenic and genetic changes have been small with the exception of winter 2002/03, when a Shangdong/7/97 type new virus caused the epidemic. It belonged to the branch of Victoria/2/87 viruses that had disappeared from Europe but remained in Asia, having caused a previous extensive epidemic in Finland in winter 1987/88. As expected, in winter 2002/03 a larger

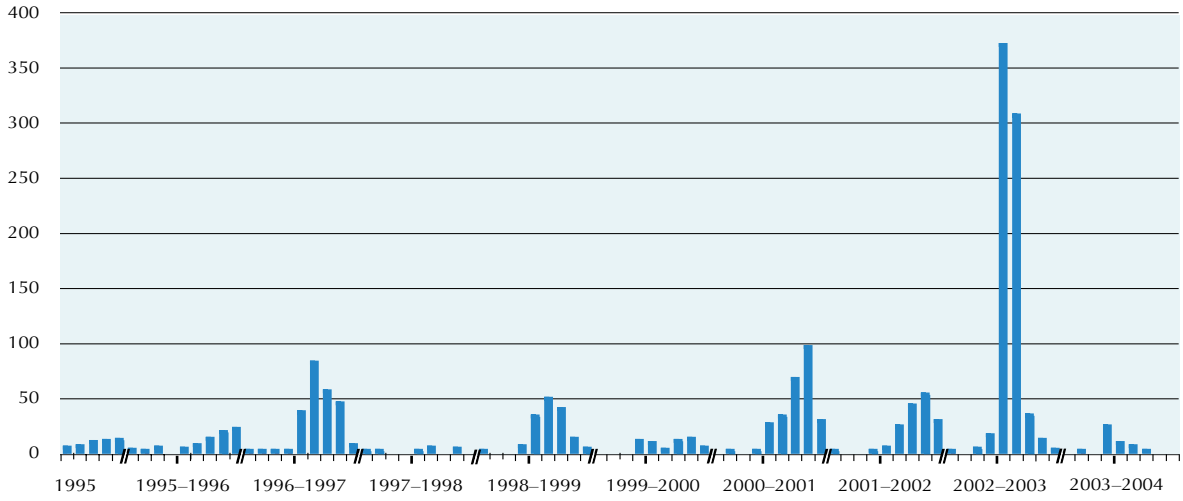


Figure 2. Influenza B cases by month 1995–2004 by epidemic season (September-May).

proportion of the findings were related to children under 15 years of age (50%) than in other winters of more than a hundred findings (weighted average 35%).

Influenza B epidemics have usually occurred later than the A epidemics. The findings peaked twice in May, three times in April and twice in February. The large epidemic in winter 2002/03 peaked as early as January. The main reason for both the intensity of the epidemic and its early outbreak was probably the weak immunity of the target population, which facilitated the spreading of the virus. The late outbreak of the small influenza B epidemics is probably explained by the minor antigenic changes in the virus and the target population's better immunity.

LEGIONELLA

In 2004, there were 16 cases of legionella infection altogether. None of the findings were based on culture. Only four infections were diagnosed by urine antigen test, and the rest by serological methods. In two cases a diagnostic rise was detected in legionella antibody test, and in ten cases there was a single significant titer. Based on physicians' notifications and further investigations it became evident that in only seven cases the clinical picture was consistent with legionellosis, i.e., the patient had clinically or radiologically diagnosed pneumonia. All four cases with a positive urine antigen test had pneumonia. Pneumonia had been diagnosed in only three patients whose antibody test showed a diagnostic rise or who had a single significant titer. All but one of the legionellosis cases were male. Their age ranged from 42 to 67 years. All patients recovered.

Five of the legionellosis cases in 2004 had been exposed during travel, e.g., in a jacuzzi pool or at a spa. These were notified to EWGLINET (the European Surveillance Scheme for Travel Associated Legionaires Disease), which collects data on travel-associated cases of legionellosis. The objective is to identify cases related to the same place of accommodation in travellers from different countries, so that preventive measures can be started as early as possible.

Underdiagnosed legionellosis

In 1995–2004, laboratories notified 5–20 findings a year suggesting legionellosis. The findings could be based on positive serology, antigen test or culture. The number of cases doubled from the period between 1995 and 2000, with an average of nine cases a year, to 2001–2004 when the annual average was already 18. Often the source of the sporadic infections remained unclear. In 1995, *Legionella pneumophila* serogroup 5, isolated from hot tap water, caused an infection in two hospital patients, and the problem recurred three years later. In 1999, a newborn baby was diagnosed with legionellosis, and the detected pathogen was of the same strain of legionella that was found in the hot piped water in the child's home.

In 2000–2003, EWGLI detected more than 200 clusters of legionellosis with the same suspected source of infection. Most of these sources were hotels. Nineteen travel-related cases of legionellosis were diagnosed in Finland during this period.

Legionellosis is probably still underdiagnosed in Finland. In addition to non-sensitive and non-specific laboratory test methods, the possibility of legionellosis is not always recalled when considering the etiology of pneumonia. A urine antigen test in combination with a legionella culture of respiratory secretions constitute the best method for diagnosing legionellosis.

WHOOPING COUGH – BOOSTER VACCINATIONS FOR SIX-YEAR-OLD BEGAN IN 2003

The total number of whooping cough cases in 2004 was higher than ever since the beginning of the

surveillance by the National Infectious Diseases Register; 1,631 cases (31.3 / 100,000). The previous peak year was 1999 with 918 cases. When the surveillance began in 1995, there were 505 notified cases, and the year with least cases during the surveillance period was 2001 with only 315 cases, right after the previous epidemic. The proportion of over 19-year-olds in 2004 was 26 percent. Epidemics focus particularly on non-vaccinated groups and on groups with insufficient immunisations, from infants to schoolchildren. The proportion of school children is explained by the short duration of humoral immunity: the levels start dropping already after five years of age. In 2004, there were 119 cases in under 1-year-olds; half of these cases (66) less than 3-month-old non-vaccinated infants and 105 under six months old. In years with a lower total number of cases there have been 11–32 cases per year in under 1-year-olds. During the previous epidemic (1999) there were 83 cases in this age group. In 2004, there were 394 cases in the age group 5–9 years and 461 in the age group 10–14 years. In order to control the epidemic, booster vaccinations for 6-year-olds were started in 2003. In the revised vaccination programme from the beginning of 2005, booster vaccinations will be administered to 4- and 14-year-olds in the future.

The figures in the National Infectious Diseases Register are based on antibody, culture and PCR findings. The findings in small children are based on conventional culture and the PCR method which has been readily available in the whole country during the last five years. Throughout the surveillance period culture findings constituted less than 5% of all findings but 20% of findings in children under one year of age. Most cases were based on antibody findings; in non-epidemic periods their proportion was more than 90%. In 2004, 29% of the cases were detected by PCR testing and 70% by antibody testing, and in 2003 the proportions were 10% and 86%, respectively. The increase in the proportion of cases detected by gene multiplication method indicates an increased number of infected infants and small children during the epidemic. Whooping cough is easier to diagnose by clinical picture in infants than in older patients. PCR testing was used

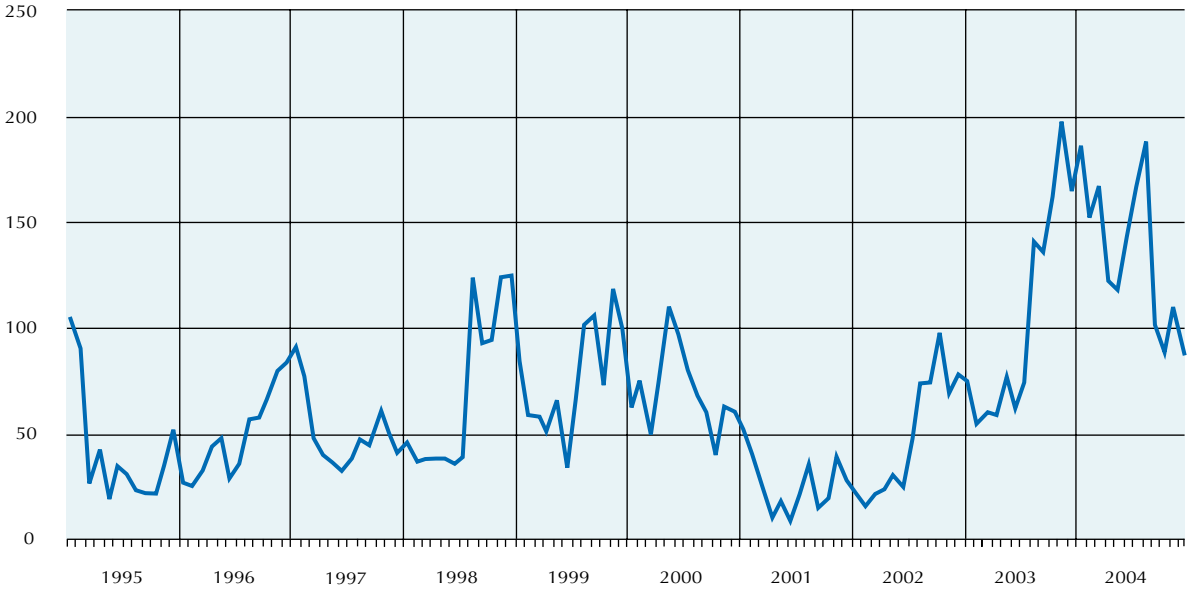


Figure 3. Whooping cough *(Bordetella pertussis)* by month 1995–2004.

beside culture also during the previous epidemic, so the diagnostics have not changed much and therefore changes in methods do not explain the increased findings among infants. They often contract the infection from their school-aged siblings. Thus, the revision of the vaccination programme also aims at reducing the morbidity of infants (Figure 3).

MYCOPLASMA

Throughout the ten-year period, the *Mycoplasma pneumoniae* findings in the register are mainly based on serological laboratory tests. Nucleic acid and antigen detection assays and/or cultures form together a consistently small, practically insignificant portion of the notified cases in each year of the surveillance period. Therefore the years are comparable as regards the detection method.

Considerable annual variation

Cases have been notified every year during the surveillance period; the highest numbers in 2004 and in 2000–2001. In autumn 1995 there were many findings and the epidemic continued in the beginning of 1996, but toward the end of the year the number of findings decreased, and the years 1997–1999 had the least cases in the period. The difference between the peak year 2004 and the years with least cases is more than sixfold. *M. pneumoniae* infections occur typically as several-months-long epidemics at a few years' intervals, but cases are detected also between epidemics. Three distinct epidemics could be identified during the ten-year surveillance period: In 1995, a moderate epidemic, five years later a more extensive two-peak epidemic that started in 2000 and continued in 2001, and three years from this a very intensive epidemic that started in 2004 and still continues in 2005. In addition to large nationwide epidemics, mycoplasma causes small local outbreaks, e.g., in garrisons or classrooms.

In each year of surveillance at least a few cases have been detected every month (Figure 4). In years with least cases there has been no distinct monthly variation. Epidemics have always begun in autumn, in October–November at the latest, continuing over New Year and subsiding in spring. During summer months cases have been sparse. The exceptionally intensive epidemic in 2004 got a brisk start as early as August and kept intensifying till November–December. At that time the figures had quadrupled from the beginning of the year.

Infections occur in all age groups, most abundantly among 10–14-year-olds, but many cases are also detected in age groups 5–9 and 15–19 years. There were few *M. pneumoniae* cases among small children and elderly persons. This is probably at least partly explained by fewer paired serum samples taken from these groups, and also by the lower sensitivity of serology in small children.

In 1995, the incidence was slightly higher among males than among females; the difference was significant only in age groups 15–19 and 20–24 and can probably be explained by infections among conscripts in garrisons. In 1996–2000, the incidence was approximately equal among both sexes. After this there was a distinct change, and in each year from 2001 to 2004 females constituted a significantly or very significantly larger proportion of cases. What is the explanation for this? It seems that 25–49-year-old women had the highest number of "extra" *M. pneumoniae* infections. The age distribution does not explain this, as the same phenomenon is clearly visible among young adults in military service age.

CHLAMYDIA PNEUMONIAE

In 2004, there were 245 laboratory-confirmed cases of *Chlamydia pneumoniae*. The number of cases has varied during the last 10 years between 188 and 430, so last year's level was close to the average (Figure 4). During the surveillance period the incidence was highest in 1996–1997 and 2003. Fin-

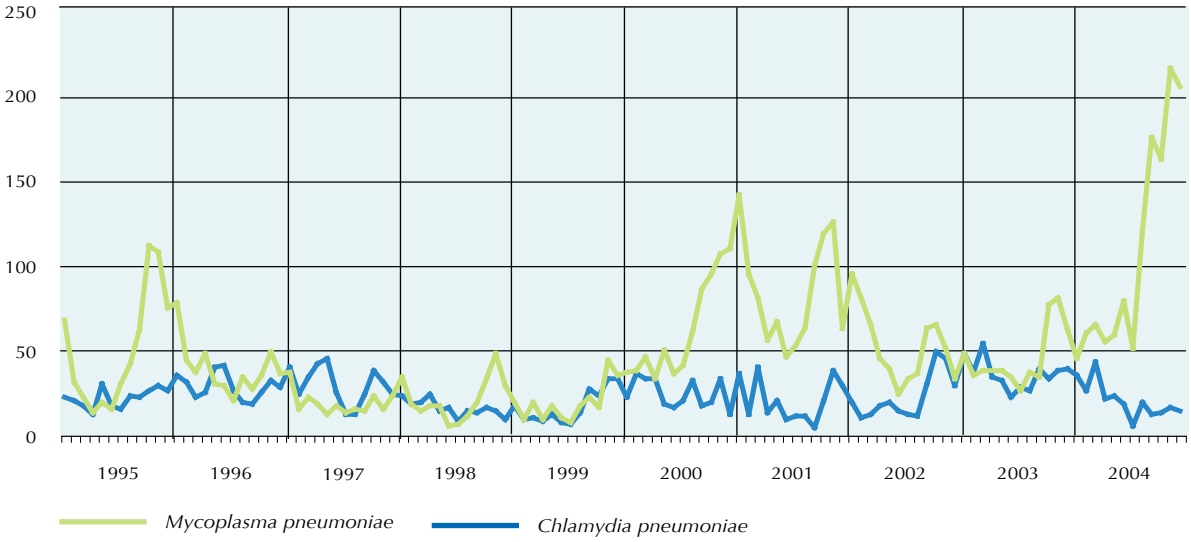


Figure 4. *Chlamydia pneumoniae* and *Mycoplasma pneumoniae* by month 1995–2004.

land has had Chlamydia pneumoniae epidemics in the late 1950s and in 1977–1978 and 1986–1987. Epidemics seem to occur at about 10-year intervals in Finland.

In 2004, more *Chlamydia pneumoniae* infections were notified for males than females in the age group under 30 years, while in the age group 30–45 years the clear majority of cases was notified among females. This is in line with the view that schoolchildren transmit the disease to their mothers and that the incidence of *Chlamydia pneumoniae* is higher among conscripts (most of them male) in the military, where it also is diagnosed more actively. In older age groups the differences between males and females are small.

In 2003, the incidence was highest in the provinces of Western Finland and Lapland, while in 1996–1997 Oulu, Lapland and Åland were the provinces with the highest incidence. In the province of Southern Finland the annual incidence does not vary nearly as much as in the less densely populated regions. Differences in diagnostic activity may partly explain the differences.

The diagnostics of *Chlamydia pneumoniae* infections are mainly based on serology. A few years ago most laboratories started using commercial EIA tests instead of the microimmunofluorescence method. The high number of cases in 2003 may partly be explained by the introduction of new, possibly more sensitive EIA methods, but the return of the number back to average level in 2004 does not support this theory.

RSV – MOST COMMON IN BABIES AND SMALL CHILDREN

Respiratory syncytial virus (RSV) causes serious respiratory infections particularly in babies and small children. However, it is also a significant pathogen in adults and elderly people, even though only 6.5 percent of the nearly 15,000 RSV findings notified in 1995–2004 were diagnosed in over five-year-old patients. The proportion of over 60-year-olds was 1.5 percent (Figure 5).

RSV has caused epidemics every year during the surveillance period, and it has been detected in the population continuously. RSV outbreaks follow the same pattern from year to year: in the

spring of an odd year there is a peak that subsides by summer. In autumn the infections begin to increase again, and a more intensive outbreak occurs around New Year. In the winter of the even year the epidemic is still intense, but only a few cases are detected in summer and the incidence does not increase significantly before New Year. A new epidemic occurs in the spring of the next, odd year.

RSV causes epidemics globally every year, but the regular pattern described above has been detected only in the Nordic countries. The rather mild spring epidemic of odd years always subsides by summer. The immunological characteristics of the relatively sparse population may be one reason for this exceptional recurrence pattern. There are two types of RS virus, RSV A and RSV B, both with subtypes. In Finland one of the main types, RSV A or RSV B, dominates for a couple of years at a time, after which the roles are reversed. A stronger immunity develops only after a child has had both types of RSV infections, but even then the immunity is not long-lasting and RS viruses cause recurrent infections. Boys form the majority of cases diagnosed in under ten-year-olds (55–60 percent).

The first RSV vaccines will probably be introduced in a few years. Old people may be the first group to receive these vaccines, and therefore more information on the frequency of RSV infections and their clinical significance is needed from all age groups in the Finnish population.

ADENOVIRUS – RARE IN ADULTS?

Adenoviruses cause respiratory and intestinal infections. They are common pathogens in infants and small children but less common in adults. Intense adenovirus epidemics occur often in the Defence Forces.

Respiratory adenovirus infections were diagnosed by antigen detection or virus culture from aspirated mucus (sputum or bronchoscopy sample) and also serologically. The number of cases was highest in the age group of under four-year-olds (average 312 cases/year) and next highest in age groups 15–19 (average 79 cases/year) and 20–24 (average 43 cases/year), i.e., the normal military

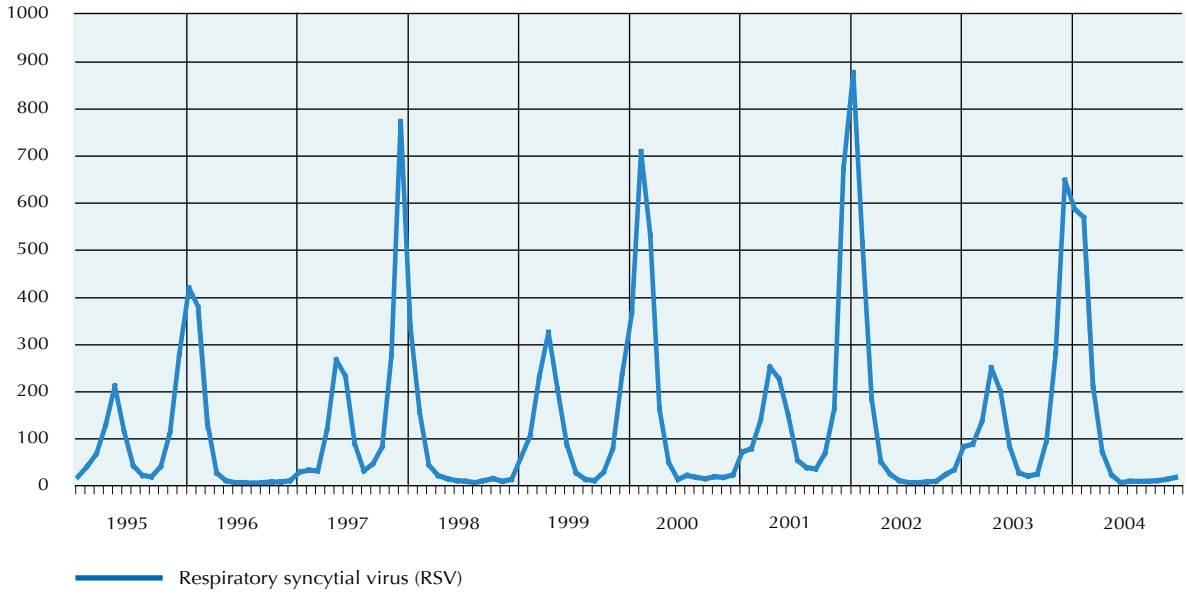


Figure 5. RSV (Respiratory syncytial virus) by month 1995–2004.

service age. Adenovirus epidemics occurred in garrisons after the arrival of new recruits. In other age groups there were fewer cases and they occurred evenly around the year (Figure 6).

PARAINFLUENZA – ESPECIALLY IN CHILDREN

Parainfluenza viruses are gathered under the same heading in the National Infectious Diseases Register, even though laboratories often separate parainfluenza viruses 1, 2 and 3. During the ten-year period parainfluenza virus infections were notified particularly in infants, small children and to some extent in small schoolchildren, more in boys than girls. Very few adults were notified with these infections.

In 1996, 2001 and 2004 the highest peaks occurred in March–May, and in 1998 and 2002 in November–December.

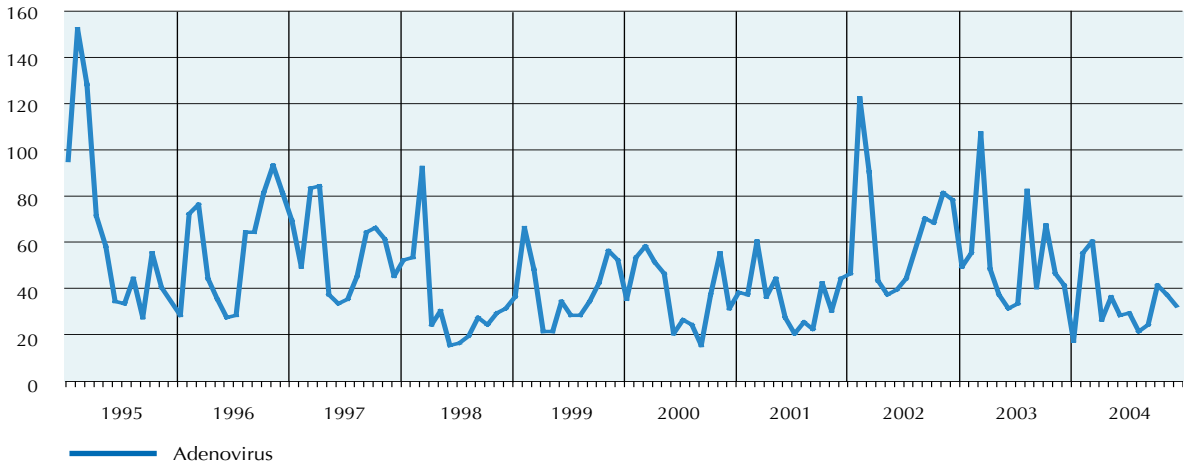
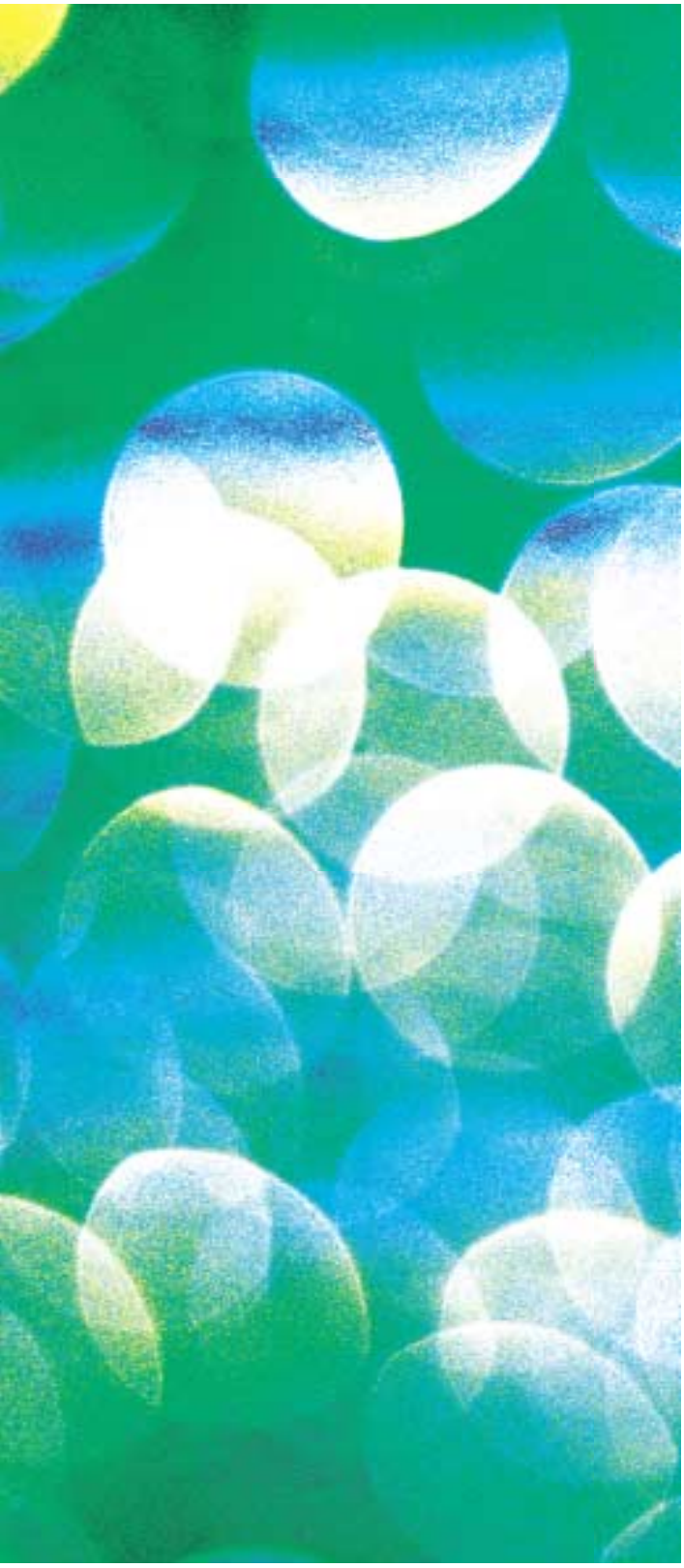


Figure 6. Adenovirus by month 1995–2004.



INTESTINAL INFECTIONS

SALMONELLA

In 2004, there were 2,248 notified salmonella cases of other serotypes than *Salmonella* Typhi or S. Paratyphi, which was approximately similar to the level in 2003. Of these cases 46% were diagnosed in males (1,025) and 54% in females (1,223). The annual incidence in the whole country was 43 cases per 100,000 population. The incidence was highest in the hospital districts of Kainuu (75/100,000) and Helsinki and Uusimaa (57/100,000) and lowest in the hospital districts of Pohjois-Pohjanmaa (27/100,000), Päijät-Häme (27/100 000) and Vaasa (28/100,000). The incidence was highest (more than 50/100,000) in the age group 20–54 years and lowest (10/ 100,000) in the age group over 75 years.

The most common *Salmonella* serotypes were Enteritidis (869 cases), Typhimurium (327 cases), Stanley (115 cases), Virchow (82 cases) and Newport (61 cases).

Of the notified salmonella infections, 320 (14%) were acquired in Finland and 1,795 (80%) abroad. No country of acquisition was specified for 139 cases (6%). S. Typhimurium serotype caused 125 (39%) of the domestic cases; the most common phage type was FT 1 (30%), an endemic phage type in Finland. The second most common serotype among the domestic cases was S. Enteritidis (87 cases, 25%). The incidence of domestic salmonella cases was 6.1 per 100,000 population; the incidence was highest among under five-year-olds (15.5/100,000). In Kainuu hospital district the incidence of domestic cases was 43/100,000, which was considerably higher than in the other hospital districts.

The incidence of salmonella cases acquired abroad was 34/100,000 population. The incidence

was highest (65/100,000) in the age group 25–29 years and in the HUS hospital district (48/100,000). The S. Enteritidis serotype caused 738 (41%) of the infections contracted abroad. The next most common serotypes acquired abroad were Typhimurium (177 cases), Stanley (104 cases), Virchow (74 cases) and Newport (52 cases). The most common countries of acquisition were Thailand, Spain, Bulgaria, Greece and Egypt, each with more than a hundred notified cases.

Serotype S. Typhi caused six cases, S. Paratyphi A four, S. Paratyphi B four, and S. Paratyphi C one case. All these infections were contracted abroad, most of them in the Indian peninsula.

Considerable improvement in 10 years

The annual number of salmonella cases in Finland has decreased clearly during the ten-year period. In the latter half of the 1990s there were still approximately 3,000 cases a year, while in the last three years the number has been clearly below 2,500. This development is seen both in domestic cases and in cases contracted abroad. (Table 1). Until 2001 Spain was the most common country of acquisition, but after that Thailand has clearly topped the list (358–406 cases per year). The number of infections contracted in Bulgaria, Egypt and Brazil has increased in recent years, whereas the number of infections acquired in Estonia, Tunisia and Morocco has decreased.

Outbreaks in 2004

In January some guests attending a wedding reception in Lapinlahti contracted salmonellosis. S. Typhimurium var. Copenhagen, FT 104, multiresistant strain, was detected in 16 guests by stool culture. The vehicle could not be identified in the questionnaire study conducted. One person with gastrointestinal symptoms, under treatment with antibiotics, had participated in the preparation of the meal. No salmonella was detected in this patient's stool culture taken after the course of antibiotics.

In February nineteen out of approximately twenty people attending a family gathering in Suomussalmi contracted S. Agona infection; the strain was susceptible to antibiotics. The source of infection remained uncertain; the person who had prepared the food was salmonella positive but symptomless.

In February–March four children at a day-care centre in Vantaa were diagnosed with an infection caused by a multiresistant S. Typhimurium FT 104 strain. Hand hygiene was enhanced at the day-care centre to get the outbreak under control.

In August some guests attending a wedding reception in Kuopio contracted salmonella infection. More than 20 persons had symptoms, and antibiotic-susceptible S. Enteridis of an extremely rare phage type FT 13var was found in the stool cultures of 16 guests. The strains were also identical in genotyping, and their DNA profile was rare. The questionnaire study conducted indicated that the vehicle was pasta salad.

In August–September five people were diagnosed with S. Enteritidis FT 8 infection, probably acquired at a football camp in Slovakia.

In September four people in Oulu contracted S. Enteritidis FT4 infection. The susceptibility of the strain to ciprofloxacin was reduced. Imported chicken was suspected as the source of infection.

In December a family's pet turtle transmitted S. Braenderup infection to six persons.

Resistance situation

In the 2000s the Laboratory for Enteric Pathogens has subjected all salmonellas to epidemiological susceptibility testing involving 12 antimicrobials (ampicillin, chloramphenicol, streptomycin, sulphonamide, tetracycline, trimethoprim, ciprofloxacin, gentamycin, nalidixic acid, cefotaxime, mecillinam, imipenem). In 2004, 13 percent of domes-

	1995		1996		1997		1998		1999
Domestically acquired infections									
Salmonella Enteritidis	378	Salmonella Typhimurium	203	Salmonella Typhimurium	499	Salmonella Typhimurium	222	Salmonella Typhimurium	375
Salmonella Typhimurium	279	Salmonella Enteritidis	104	Salmonella Enteritidis	79	Salmonella Newport	66	Salmonella Agona	85
Salmonella Stanley	95	Salmonella Infantis	29	Salmonella Hadar	31	Salmonella Enteritidis	59	Salmonella Enteritidis	83
Salmonella Infantis	73	Salmonella Poona	17	Salmonella Infantis	24	Salmonella Saintpaul	22	Salmonella Hadar	10
Salmonella Panama	26	Salmonella Stanley	15	Salmonella Newport	22	Salmonella Infantis	21	Salmonella Poona	10
others	161	others	98	others	126	others	121	others	93
total	1 012		466		781		511		656
Infections acquired abroad									
Salmonella Enteritidis	971	Salmonella Enteritidis	960	Salmonella Enteritidis	912	Salmonella Enteritidis	944	Salmonella Enteritidis	892
Salmonella Typhimurium	127	Salmonella Typhimurium	171	Salmonella Typhimurium	159	Salmonella Typhimurium	133	Salmonella Hadar	112
Salmonella Infantis	111	Salmonella Virchow	144	Salmonella Virchow	85	Salmonella Virchow	82	Salmonella Typhimurium	103
Salmonella Virchow	75	Salmonella Hadar	65	Salmonella Hadar	57	Salmonella Hadar	79	Salmonella Virchow	76
Salmonella Hadar	48	Salmonella Infantis	60	Salmonella Newport	34	Salmonella Infantis	67	Salmonella Braenderup	38
others	827	others	867	others	733	others	827	others	680
total	2 159		2 267		1 980		2 132		1 901
Country of acquisition not specified									
number of cases	144		140		231		301		476
Total	**3 315**		**2 873**		**2 992**		**2 944**		**3 033**

	2000		2001		2002		2003		2004
Domestically acquired infections									
Salmonella Typhimurium	124	Salmonella Typhimurium	152	Salmonella Typhimurium	224	Salmonella Typhimurium	137	Salmonella Typhimurium	125
Salmonella Enteritidis	52	Salmonella Enteritidis	63	Salmonella Enteritidis	42	Salmonella Enteritidis	61	Salmonella Enteritidis	78
Salmonella Agona	27	Salmonella Agona	41	Salmonella Hvittingfoss	26	Salmonella Newport	16	Salmonella Agona	27
Salmonella Hadar	17	Salmonella Infantis	19	Salmonella Agona	16	Salmonella Agona	12	Salmonella Stanley	7
Salmonella Virchow	15	Salmonella Ohio	12	Salmonella Abony	15	Salmonella Poona	9	Salmonella Newport	7
others	90	others	103	others	86	others	75	others	76
total	325		390		409		310		320
Infections acquired abroad									
Salmonella Enteritidis	1 046	Salmonella Enteritidis	1 238	Salmonella Enteritidis	905	Salmonella Enteritidis	887	Salmonella Enteritidis	738
Salmonella Typhimurium	204	Salmonella Typhimurium	139	Salmonella Typhimurium	115	Salmonella Typhimurium	155	Salmonella Typhimurium	177
Salmonella Hadar	125	Salmonella Hadar	96	Salmonella Hadar	69	Salmonella Stanley	67	Salmonella Stanley	104
Salmonella Braenderup	49	Salmonella Virchow	79	Salmonella Stanley	64	Salmonella Virchow	67	Salmonella Virchow	74
Salmonella Virchow	49	Salmonella Stanley	62	Salmonella Virchow	55	Salmonella Hadar	58	Salmonella Newport	52
others	747	others	757	others	637	others	628	others	650
total	2 220		2 371		1 845		1 862		1 795
Country of acquisition not specified									
number of cases	223		145		103		107		139
Total	**2 768**		**2 906**		**2 357**		**2 279**		**2 254**

Table 1. The most common serotypes of salmonella cases 1995–2004 (*S.* Typhi and *S.* Paratyphi not included).

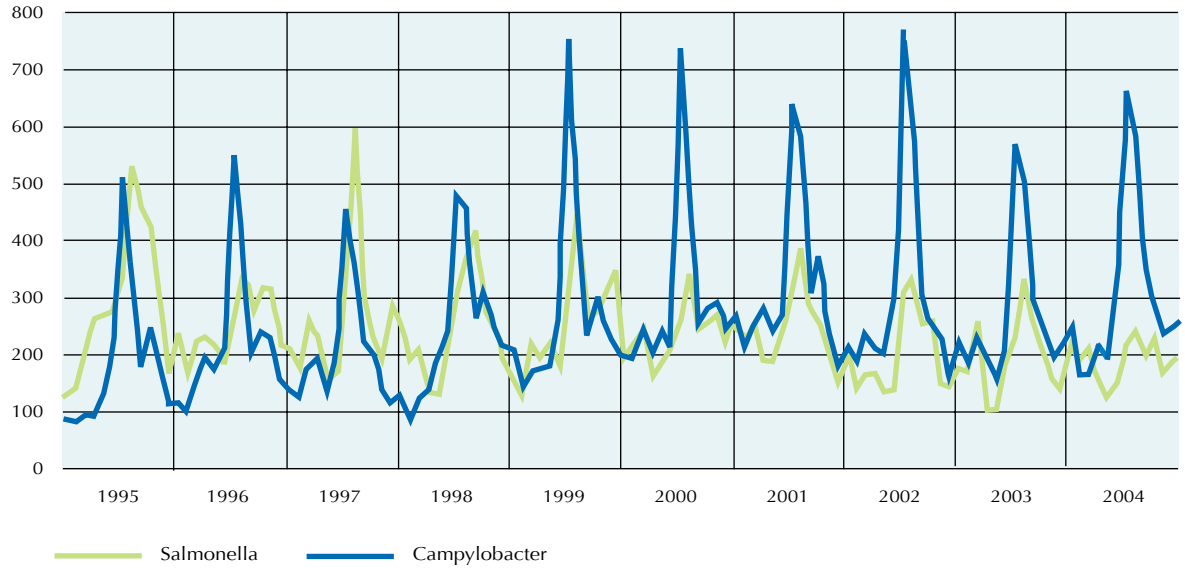


Figure 7. Salmonella and Campylobacter cases by month 1995–2004.

tic and 10 percent of strains acquired abroad were multiresistant (resistant to at least 4 antimicrobials). In 2001–2002, the respective percentages were 11 and 10. Nearly all domestic multiresistant strains were of type Typhimurium, FT 104. It is somewhat alarming that domestic infections caused by this invasive salmonella type have increased continuously (3% of all domestic infections in 2002, 9 % in 2003, 10 % in 2004). Particularly Thailand and Egypt can be regarded as the "storage" for multiresistant strains. Among them multiresistance was often associated only with certain serotypes, like Stanley, Panama and Rissen serotypes in Thailand and Newport, Virchow and Kentucky serotypes in Egypt. The resistance of the last-mentioned serotype was particularly striking: more than 30% of strains were fully resistant (MIC ≥ 4 mg/l) to ciprofloxacin. The resistance to nalidixic acid can be used to predict reduced susceptibility to ciprofloxacin. In 2004, 11 percent of domestic strains (9% in 2001–2002) and 24 percent of strains acquired abroad (24% also in 2001–2002) were resistant to nalidixic acid.

CAMPYLOBACTER – INCIDENCE BEGAN TO RISE AGAIN

The declining trend of campylobacter cases ceased in 2004, and the number of notified cases was approximately 13% higher than the preceding year. Ninety-five percent of the notified cases were caused by *Campylobacter jejuni* and five percent by *Campylobacter coli*. Fifty-four percent of the cases were male. The incidence in the entire population was 69/100,000. The majority of notified cases (53%) was detected in the age group 20–44 years, with an incidence of approximately 100/100,000 population.

Since the beginning of 2004, information has been collected on travel preceding campylobacter infections making it possible to distinguish infections acquired in Finland from those acquired abroad. The information on the possible place of acquisition was obtained from 2,150 patients (61%). Sixty-eight percent of these had been abroad just prior to becoming ill.

The number of notified campylobacter cases exceeded the number of salmonella cases for the

first time in 1998, and since then campylobacter has been the most common bacterial cause of intestinal infections in Finland (Figure 7). Since 1999, more than 3,000 cases have been notified each year. The seasonal variation typical for campylobacter infections is visible in the figures of 1995–2004. Every year the peak month of incidence has been July. Similar seasonal variation has been detected in other Nordic countries as well.

Based on the investigations conducted by the Laboratory for Enteric Pathogens at the National Public Health Institute, the majority (68%) of infections detected in July–August were acquired domestically.

In the age distribution of campylobacter cases there is a distinct peak in the age group of young adults, which probably reflects the popularity of travelling among them. The number of cases increased in 1995–2001 in the age group 15–64. Among under 15-year-olds and over 65-year-olds the incidence has remained approximately at the same level for the past ten years.

The incidence of campylobacter infections in 1995–2004 was highest in the hospital district of Helsinki and Uusimaa, where the incidence per 100,000 population has varied approximately from 100 to 150. The year 1998 was an exception, as the highest individual regional incidence during the ten years of surveillance was detected in the hospital district of Ahvenanmaa (173/100,000). Last year the incidence in the Ahvenanmaa hospital district was the lowest (22/100,000) in all of Finland (Figure 8).

Figure 8. Incidence of Campylobacter cases by hospital district in 2004.

YERSINIA

In 2004, there were 681 notified cases of yersinia. Eighty-one percent of these were *Yersinia enterocolitica* infections and 19 percent were *Yersinia pseudotuberculosis* infections.

The incidence of the different yersinia species varied between age groups. The highest number of *Y. enterocolitica* infections was detected in over 40-year-olds, while the incidence of *Y. pseudotuberculosis* was highest among those under 15 years of age .

The highest incidences of *Y. pseudotuberculosis* infections were detected in the hospital districts of Keski-Pohjanmaa and Pohjois-Pohjanmaa (23/100,000 and 10/100,000, respectively). The hospital districts with the highest incidence of *Y. enterocolitica* infections were Kainuu (19/100,000), Ahvenanmaa (19/100,000) and Helsinki and Uusimaa (18/100,000).

The number of yersinia cases notified to the register was 923 in 1995 and 852 in 1996. After that

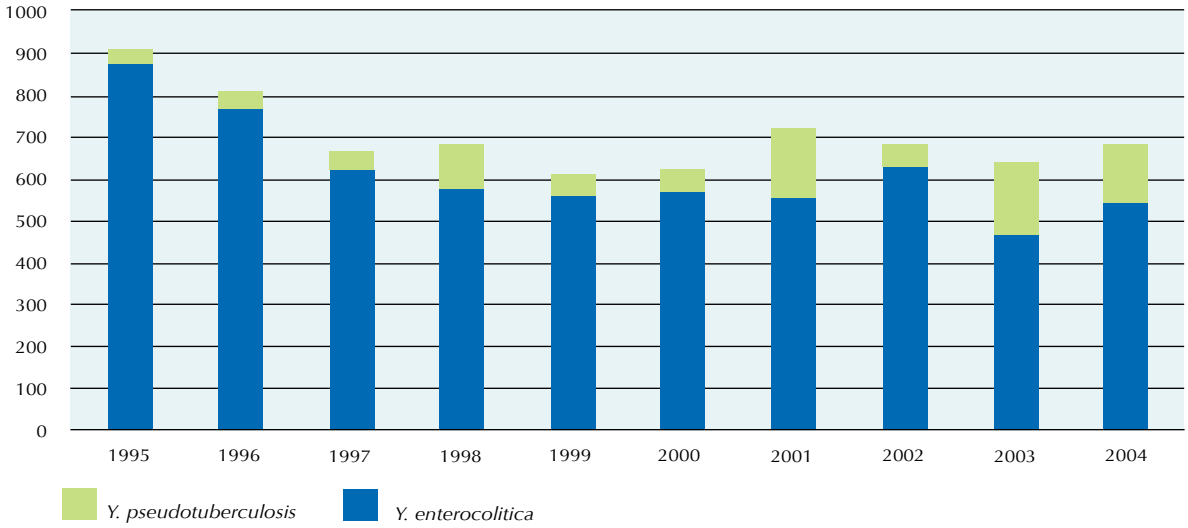


Figure 9. *Yersinia enterocolitica* and *Y.pseudotuberculosis* cases 1995–2004.

approximately 600–700 cases have been notified each year (Figure 9). Annually there have been 400–600 notified cases of *Y. enterocolitica* and 30–180 of *Y. pseudotuberculosis*. The incidence of yersiniae has remained at the same level for the past eight years.

Yersinia outbreaks – outbreak investigations conducted in many regions

In 2004, there was an outbreak caused by the O:1 serotype of *Y. pseudotuberculosis* among schoolchildren in Haapavesi, and it manifested itself also as a wide-spread regional outbreak in the hospital districts of Vaasa, Keski-Pohjanmaa and Pohjois-Pohjanmaa. The investigation of the school outbreak and a population-based case-control study again identified domestic carrots as the source of infection. The farm where the carrots were grown was not the same one where the source of the previous year's epidemic was traced to. Two different genotypes were detected in the patient strains. One of them was identical to the genotype found in the strains isolated from the traced farm's carrots and the shrews caught in the carrot field.

Y. enterocolitica infections have occurred mainly as sporadic cases in different parts of the country, but some smaller outbreaks have also been detected. No association has been established between the cases and any particular food(s) so far. It is probable that in regions with high incidence, epidemics manifest themselves as sporadic cases, and therefore it is hard to find a connecting factor.

SHIGELLA – USUALLY CONTRACTED ABROAD

The incidence of shigellosis in 2004 was 2.1/100,000 population. Altogether 109 cases were notified, and 47 of the patients were male. The highest incidence (5.3/100,000) was detected in the age group 25–39 years. No cases were notified among those aged 75 years or more. More than half of the cases (57) were notified from the hospital district of Helsinki and Uusimaa, where the incidence was also higher than in the other hospital districts (4.0/100,000). More than 90 percent of the infections were contracted abroad. The most common country of acquisition was Egypt, like many times earlier. The number of cases acquired in Brazil (11) was higher than be-

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Infections acquired in Finland	5	10	9	8	4	8	50	6	3	6
Infections acquired abroad	67	85	86	73	63	61	170	76	60	98
Egypt	3	8	9	1	11	15	53	18	18	37
India	16	14	21	8	2	10	10	10	8	13
Turkey	8	16	3	20	6	2	21	10	1	5
others	40	47	53	44	44	34	86	38	33	43
Place of acquisition unknown	1	12	9	7	4	6	3	5	3	5
Total	**73**	**107**	**104**	**88**	**71**	**75**	**223**	**87**	**66**	**109**

Table 2. Shigella infections acquired domestically and abroad 1995–2004.

fore. More than half of the infections acquired in India, China and Sri Lanka were caused by strains with reduced susceptibility to ciprofloxacin. Seventy-five percent of the cases were caused by *Shigella sonnei* and 16 percent by *Shigella flexneri*. Only one *Shigella dysenteriae* infection was detected.

With the exception of year 2001, there have been 70–110 cases of shigella notified in Finland each year. In 2001, the number of cases was as high as 223, which is partly explained by a restaurant outbreak in Kymenlaakso. That year there were also exceptionally many infections contracted in Egypt, which was mainly due to increased tourism to that country (Table 2).

The majority of infections have been acquired abroad, and the number of domestic cases has normally been fewer than 10. Egypt has been the most common country of origin throughout the surveillance period, followed by India and Turkey. In the entire period from 1995 to 2004, *Shigella sonnei* has caused 72 percent and *Shigella flexneri* 19 percent of all cases.

EHEC – FEWER CASES THAN EVER IN 2004

In 2004, ten microbiologically confirmed cases of Enterohemorrhagic *Escherichia coli* (EHEC) were notified (0.2/100,000/year), five of them males. The

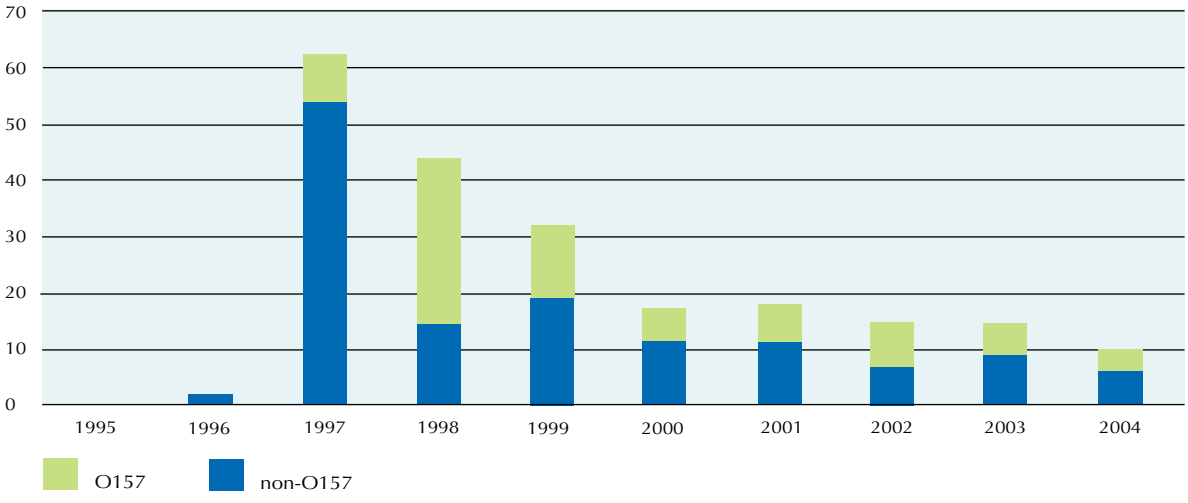


Figure 10. EHEC findings 1996–2004

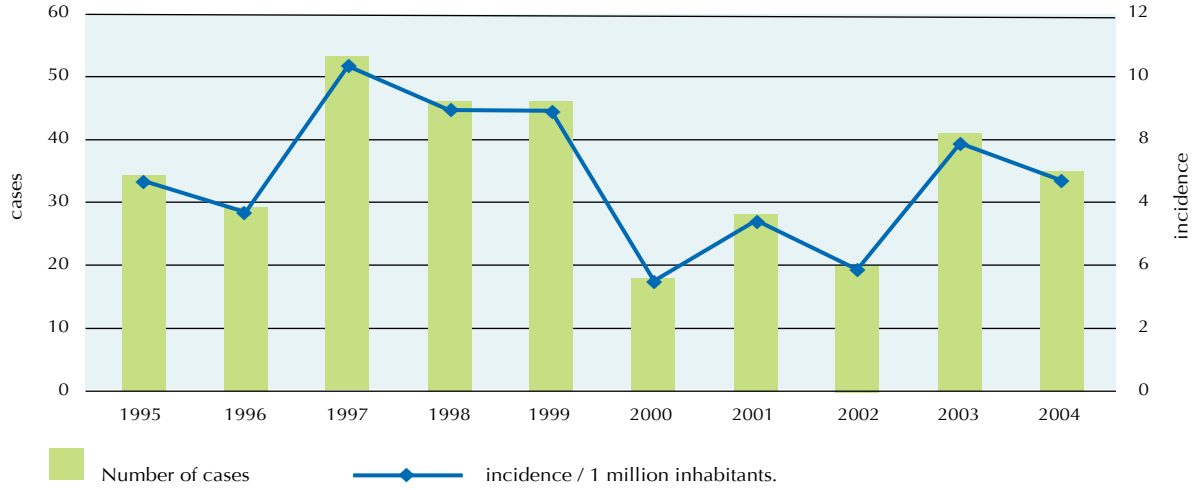


Figure 11. Incidence of listeriosis cases 1995–2004.

total number of cases was smaller than ever since 1996 (Figure 10), when EHEC was added to the list of category A notifiable communicable diseases.

All cases were under 40 years old, among them two under five-year-olds. None of them developed haemolytic uraemic syndrome (HUS).

Six of the infections were contracted in Finland and four abroad. One of the domestic cases was a child under five. Four of the cases were caused by the EHEC O157:H7 serotype, three of them acquired abroad. Six cases were caused by EHEC non-O157:H7 serogroup, five of them of domestic origin. With the exception of two cases caused by non-O157 serogroup in the members of the same family, all domestic EHEC non-O157 cases were caused by different serogroups. All cases who had acquired EHEC non-O157 infection in Finland either lived on a cattle farm or were otherwise in close contact with a cattle farm.

The annual incidence of EHEC cases in Finland has been internationally very low (0.3–0.9/100,000), and the trend has still been downward in recent years. In 1998, the O157 serogroup constituted more than half of all cases, but after that the proportion of non-O157 strains has become considerable (Fig 10). HUS was diagnosed in 16 patients (11 O157 cases and 5 non-O157 cases). Twelve of these were under five-year-olds, and twelve were girls. In 1998, two small EHEC O157:H7 clusters were detected. One of them probably resulted from infection being transmitted from person to person, and the other one was possibly due to infections transmitted by hamburgers.

LISTERIA – CASE FATALITY RATE 23 PERCENT

The annual incidence of listeriosis in 2004 was seven cases per million population.

A total of thirty-five cases were notified. Fifty-one percent of the patients were male and 71 percent were 65 years of age or older (Figure 11).There were 25 cases with findings from blood and three from CSF, and six with findings from other aspirated samples. Six cases had a malignant haematological disease as a predisposing factor, and one case had other cancer. Only two cases had no predisposing underlying condition. Eight of the cases (23%) died, three of them within a week after the positive listeria finding, and seven within a month. One of the cases was pregnant. No infections were detected in neonates. Listeriosis was detected in nearly all hospital districts with the number of cases ranging from zero to five.

Serotype 1/2 caused 73 percent of the cases, and serotype 4b caused 27 percent. Seven of the serotype 4b listeria strains were of the same listeria genotype. This genotype could not be traced to any individual food product. It caused infections in many hospital districts around Finland (Table 3).

The National Food Agency, the National Veterinary and Food Research Institute and the National Public Health Institute informed the public three times in 2000 and once in spring 2003 that vacuum-packed rawpickled or cold-smoked fish may be contaminated by *Listeria monocytogenes*, which can cause illness in risk groups. In 2004, at least three cases were diagnosed with a listeria infection caused by a genotype isolated earlier from vacuum-packed smoked and rawpickled fish. There were three similar cases of listeriosis in 2002 and eleven in 2003. In 1997–1999, serotype 3a caused listeria infections that were for the most part related to an epidemic transmitted by butter.

NOROVIRUSES – MOST INFECTIOUS IN WINTER

In 2004, there were 125 notified cases of norovirus, 70 of them females. More cases were notified during the winter months than during the rest of the year. The incidence 2.4/100,000 was clearly lower than in the two preceding years. The highest incidence was detected among under five-year-olds (6.0/100,000), but cases were notified from all age groups. The incidence was highest in the hospital districts of Varsinais-Suomi and Helsinki and Uusimaa, which probably indicates that these districts employ a more active diagnostic practice. December was clearly the peak month for notified cases (26).

The diagnostics of norovirus infections are based either on a PCR test or on electron microscopy, which are less readily available than, for example, a stool culture. Therefore the notified norovirus cases indicate poorly the actual number of infections. From 1998 to 2004, 125–836 norovirus cases per year were notified to the National Infectious Diseases Register. The incidence was highest in 2002. A new norovirus genotype appeared then, causing exceptionally abundant infections around the world. At the end of last year a new norovirus type was detected in Finland and elsewhere in Europe. The increased incidence toward the end of the year is probably related to the appearance of this new type.

ROTAVIRUS

In 2004, the incidence of rotavirus was 25/100,000; there were 1,322 notified cases, 712 male and 610 female. Rotavirus infections were most common in January–June. The incidence was clearly highest among children under five years of age (418/100,000); they constituted 90 percent of all cases. Cases were notified from all hospital districts except Ahvenanmaa.

In 1995–2004, the annual incidence of rotavirus has been 20–42/100,000 population. The incidence begins to rise around New Year, peaks in March–May, drops during summer months and is at

Serotype	1995 n=21	1996 n=21	1997 n=47	1998 n=43	1999 n=45	2000 n=19	2001 n=27	2002 n=20	2003 n=40	2004 n=32
1/2	15	15	27	19	25	16	20	13	36	23
3a	1	0	4	19	10	0	0	0	0	0
4b	5	6	16	5	10	3	7	7	4	9

Table 3. Serotype distribution of *Listeria monocytogenes strains* 1995–2004.

its lowest in autumn. Rotavirus patients are typically small children; 6–24 months is the age group with the highest incidence.

FOOD- AND WATER-BORNE OUTBREAKS

Notification system for suspected outbreaks implemented in 1997

Since 1997, Finland has employed a special notification system for suspected food- and water-borne outbreaks. Its purpose is to serve as an early and fast channel of communication when local health or environmental authorities have detected gastrointestinal illness suspected to be caused by food or potable water. Since 1997, the number of outbreak investigation reports to the National Food Agency has approximately tripled from the preceding years.

Whenever necessary, the National Public Health Institute (KTL) assists the municipal authorities in investigating an outbreak, or it may also assume the main responsibility particularly when the number of ill is high or an epidemic occurs in several municipalities or hospital districts. New food vehicles have been identified in KTL's outbreak investigations in recent years, such as butter in a listeria outbreak and iceberg lettuce in a *Yersinia pseudotuberculosis* outbreak. KTL has also investigated the modes of transmission in other than food- and water-borne epidemics. Examples of these include a tularemia outbreak in 2000 and a Pogosta disease outbreak in 2002.

Cause	n	%
Unknown	38	34,5
Norovirus	35	31,8
Salmonella	8	7,3
Biogenic amine	6	5,5
Cl. perfringens	5	4,5
Yersinias	5	4,5
Staph. aureus	4	3,6
Bacillus cereus	4	3,6
Campylobacter jejuni	2	1,8
Other bacterium	2	1,8
Chemical substance	1	0,9
Total	**110**	**100**

Table 4. Aetiology of food-borne epidemics in Finland 2001–2003.

In 2004, KTL received 67 notifications of suspected outbreaks. A *Yersinia pseudotuberculosis* outbreak in Pohjanmaa in March led to detailed investigations; in addition to local authorities the investigators included KTL, the National Veterinary and the Food Research Institute of Finland (EELA), the Finnish Forest Research Institute and the National Food Agency. Epidemiological and microbiological investigations showed that the infections had been transmitted by carrots. The flooding due to the summer's heavy rainfall contaminated water at many municipal water works. Major water-borne epidemics were, however, avoided.

Since 2001, applying uniform criteria, a working group formed by KTL, the National Food Agency and the National Veterinary and Food Research Institute of Finland has evaluated the strength of the evidence on outbreaks reported as food- or water-borne. The association to food or potable water is graded as strong, probable, possible, weak or none, the last-mentioned indicating that there is no evidence on the epidemic being food- or water-borne. In 2001–2003, there were 275 notified outbreaks, and 129 of them were assessed to be transmitted by food or potable water. Food-borne outbreaks constituted 110 of these, and 19 outbreaks were water-borne. Most of the outbreaks that were assessed to have some other way of transmission were norovirus epidemics transmitted from person to person.

The most usual microbial causes of food-borne epidemics were norovirus, salmonella, *Clostridium perfringens* and yersiniae (Table 4). The most common food vehicles included meat, vegetable and fish products. In more than a third of the outbreaks the source was food served in a restaurant. In nineteen outbreaks the infections were

probably transmitted by an infected employee; in most of these cases the employee had a norovirus infection. Norovirus and *Campylobacter jejuni* were the most common microbes causing water-borne epidemics.

Salmonella – 1–8 outbreaks per year

During the current outbreak notifying system 1–8 food-borne salmonella outbreaks have been observed each year in Finland. Around New Year 1997–1998 about a hundred persons attending two funerals were infected by *Salmonella* Newport. Ham was identified as the source of infection in the questionnaire study conducted. At the same time infections caused by the same salmonella strain were detected in England.

In May 1999, more than 70 people in Southern Finland contracted *S.* Typhimurium FT 193. Alfalfa sprouts were identified as the source of infection in a case-control study.

In August 1999, cheese made from milk bought directly from a farm caused an outbreak with more than 100 persons becoming ill in Varsinais-Suomi.

Campylobacter – the cause of many water-borne epidemics

Food poisonings caused by Campylobacter have occurred as sporadic cases, and outbreaks have been small (3–15 ill persons). The vehicles or suspected vehicles have included turkey, milk bought directly from a farm, chicken prepared with sour cream, fresh strawberries and chicken fillets.

Instead, campylobacter has caused many water-borne outbreaks in the past ten years. Extensive outbreaks associated with municipal water intake plants occurred in Haukiputaa in 1998, Asikkala in 2000 and Vihti and Kangaslampi in 2001. Several thousand persons in total became ill in these outbreaks. In 2001, an outbreak transmitted by natural water occurred in Lapland, with all 17 members in a group of hikers becoming ill after drinking creek water. In 2003, there was a small family outbreak in Lapland, when spring water had been used for drinking in a rental cottage.

Shigella – many cases from Egypt in 2001

In 2001, there were 222 notified cases of shigella, which is an exceptionally high figure. This is partly explained by a *Shigella sonnei* outbreak in Kymenlaakso in August–September, with more than 40 persons falling ill. The cases had dined at the same café serving home-made food. One of the employees of the cafe had shigella infection, probably acquired in Tallinn.

EHEC – outbreak caused by kebab

In 2001, a small EHEC O157:H7 outbreak occurred in Finland, and foreign kebab meat was identified as the source of infection.

Listeria – outbreak caused by butter

In 1998–1999, *Listeria monocytogenes* serotype 3a caused an outbreak transmitted by butter, with 25 people becoming ill. The listeria strains isolated from the patients and the butter produced by one manufacturing plant had also similar genotypes.

Yersinia – outbreaks caused by school food

In the past ten years, *Y. pseudotuberculosis* has caused recurring outbreaks of food poisoning. Many of them have been associated with eating at school. In 1997–1999, the most common cause of outbreaks was *Y. pseudotuberculosis* serotype O:3. Serotypes O:3 and O:1 were identified in the 2001 epidemic.

The first such outbreak was detected in August 1997 in the Pirkanmaa hospital district. In Au-

gust 1998, another outbreak in a school occurred in the same hospital district. Vegetables were suspected as the vehicle already then.

A wide-spread regional outbreak occurred also in Southern Finland in autumn 1998. In a population-based case-control study, domestic iceberg lettuce was identified as the source of infection. A regional outbreak occurred also in 1999.

Several small clusters caused by serotypes O:1 and O:3 occurred simultaneously in the Kainuu, Mikkeli and Pori regions in 2001.

In the following autumn, 2002, an outbreak caused by *Y. pseudotuberculosis* serotype O:3 occurred in the Kymenlaakso region.

In spring 2003, *Y. pseudotuberculosis* serotype O:1 caused an extensive food poisoning outbreak among schoolchildren in Kymenlaakso. The number of ill was estimated to be about 800. The investigation showed that domestic carrots were the source of infection. For the first time a strain with the same serotype and genotype was isolated both from the cases and the carrots traced to the farm of origin.

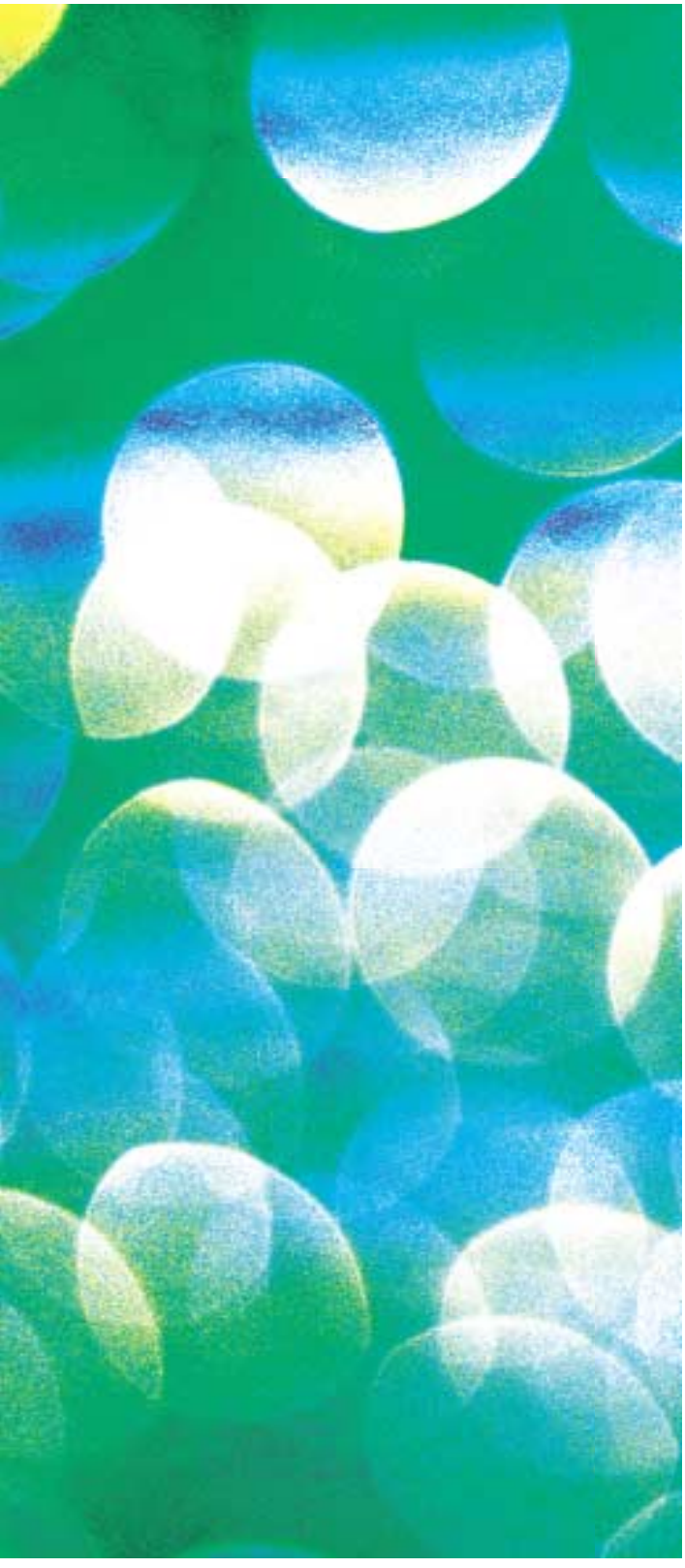
A the end of 2003, *Y. enterocolitica,* serotype O:3, caused an outbreak in Kymenlaakso, with more than 20 persons contracting severe abdominal symptoms and three persons having an unnecessary appendectomy. In December 2004, serotype O:3 caused a cluster of infections at a ski centre.

Norovirus – the cause of outbreaks transmitted by domestic water

Norovirus has caused many extensive outbreaks transmitted by potable water in Finland. Norovirus has also been transmitted by food. At the end of the 1990s imported frozen berries were identified as the source of infection in many outbreaks. In the most extensive outbreak in 1998 about 500 persons became ill.

In 1998, 1,700–3,000 people in Heinävesi were estimated to have fallen ill due to water-borne norovirus infection.

In 2000, in Nurmes it was estimated that up to 5,000 persons fell ill.



HEPATITIDES

HEPATITIS A

In 2004, there were 42 notified cases of hepatitis A, 19 males and 23 females. The annual incidence was 0.8/100,000 population, which was considerably lower than in the previous year. There were patients in all age groups, but the incidence was highest among 30–34-year-olds. Ten hospital districts had no detected cases. Eleven infections had been acquired in Finland, 20 abroad, and 11 were of unknown origin.

The incidence of hepatitis A has varied considerably in Finland. During the outbreak among IDUs (injecting drug users) in the capital region in 1994–1995 the incidence rose markedly; more than 400 cases were registered in 1994. After this the incidence decreased gradually, and in 1999–2001 approximately 50 cases per year were notified, about half of which were acquired abroad (Table 5). Russia (62 cases), Estonia (42 cases) and Turkey (26 cases) have been the most common countries of acquisition other than Finland among the registered cases in the past ten years. In association with the outbreak among IDUs in 2002–2003, the incidence increased nearly tenfold from the previous years. In 2002, an extensive vaccination campaign was carried out in the capital region among IDUs, and this seemed to control effectively the epidemic. In 2003, smaller outbreaks occurred among IDUs in other hospital districts.

As outbreaks among IDUs have become a recurrent phenomenon, hepatitis A vaccination for this risk group was included in the general vaccination programme in the beginning of 2005.

Year	Domestic Origin	Foreign origin	Unknown origin	Total
1995	81	34	49	164
1996	90	40	56	186
1997	73	48	48	169
1998	58	36	26	120
1999	17	19	12	48
2000	18	24	9	51
2001	25	20	6	51
2002	293	37	63	393
2003	154	16	72	242
2004	9	20	13	42

Table 5. Hepatitis A cases 1995–2004.

HEPATITIS B

Fewer acute hepatitis B cases among injecting drug users

The number of acute hepatitis B cases notified to the National Infectious Diseases Register has clearly decreased during the past 10 years (Table 6). The most rapid decrease has occurred in cases transmitted by injecting drugs. Early in the surveillance period distinct smaller outbreaks occurred among drug users in different parts of the country, for example in Kuopio and Turku.

Probable reasons for the decreased number of cases include both the extensive needle and syringe exchange programme and the hepatitis B vaccinations offered to drug users especially at the needle/syringe exchange centres. Further proof of the efficiency of exchange programme is the fact that in recent years hepatitis B cases associated with the use of injecting drugs have occurred mainly in places without any needle/syringe exchange centres, like Vaasa. The decreased number of hepatitis C infections also indicates the importance of clean injection equipment in hepatitis prevention (Figure 12).

	1995		1996		1997		1998		1999	
	Acute HBV	HCV	Acute HBV	HCV	Acute HBV	HCV	Acute HBV	HCV	Acute HBV	HCV
Injecting drugs	15	..	57	..	56	..	76	1 019	106	986
Sex	21	..	45	..	58	..	44	54	36	34
Perinatal	0	..	1	..	1	..	1	4	0	10
Blood products	22	..	69	..	52	..	4	24	1	22
other	3	..	20	..	11	..	4	24	9	40
unknown	51	..	98	..	137	..	117	678	103	660
Total	**112**	**1 358**	**290**	**1 778**	**316**	**1 904**	**246**	**1 803**	**256**	**1 753**

	2000		2001		2002		2003		2004	
	Acute HBV	HCV	Acute HBV	HCV	Acute HBV	HCV	Acute HBV	HCV	Acute HBV	HCV
Injecting drugs	82	920	28	814	43	693	18	619	8	578
Sex	39	39	41	41	37	46	19	45	15	57
Perinatal	1	6	0	3	1	3	1	2	0	9
Blood products	1	24	1	18	1	18	0	22	2	18
other	8	30	6	31	2	28	1	33	4	30
unknown	108	720	51	583	92	582	67	543	28	546
Total	**239**	**1 739**	**127**	**1 491**	**176**	**1 371**	**106**	**1 265**	**57**	**1 238**

Between 1995–2004 four HBV cases have been notified to have been transmitted by Finnish blood products. Since 2000 no cases of HCV transmitted by Finnish blood products have been notified. The surveillance for the mechanism of transmission for HCV was started in 1998.

Table 6. Acute hepatitis B cases and all hepatitis C cases by mode of transmission 1995–2004.

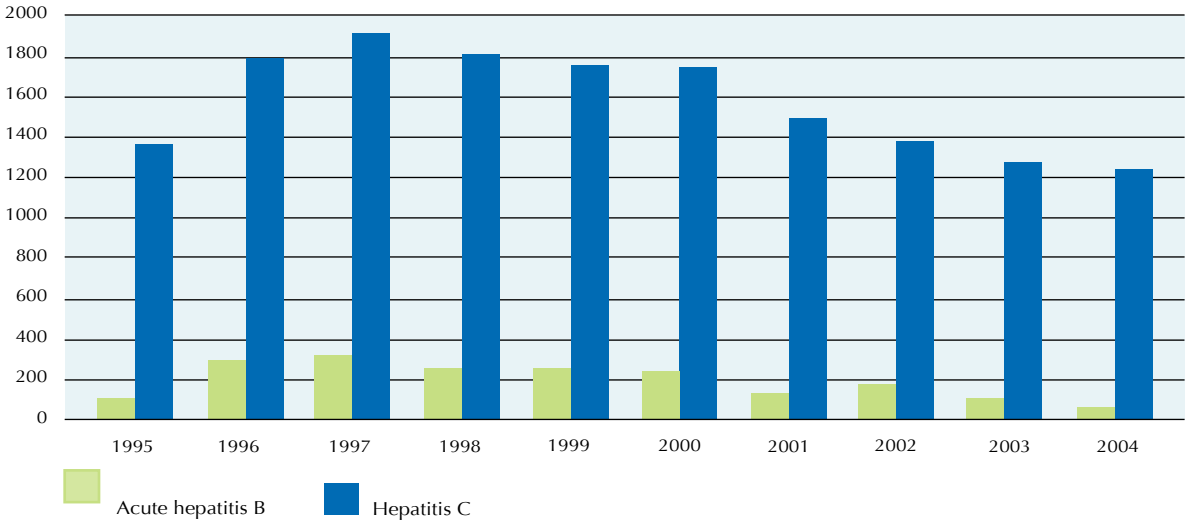


Figure 12. Acute hepatitis B cases and all hepatitis C cases 1995–2004.

Mode of transmission is not always notified

The mode of transmission has been notified for only about every third hepatitis B case. While in 1998 two thirds of the acute infections with mode of transmission notified were still related to drug use, these cases constituted only about one third of the cases in 2003 and 2004. Due to efficient screening during pregnancy, practically all infected neonates in Finland are foreigners. These cases were born and infected in countries with inadequate or nonexistent screening during pregnancy. In the 2004 statistics, a third of acute cases were diagnosed in patients of foreign origin.

There were still sporadic travel-related cases, even though the combined hepatitis A and B vaccine has become more and more common among travelling Finns over the past decade. In recent years more than half of the hepatitis B vaccine used in Finland has been administered to travelers.

Chronic hepatitis B

The notified chronic hepatitis B carrier states indicate both infections contracted in the past and current potential sources of infection.

Chronic carrier states accumulate in people of foreign origin. In recent years more than half of the notified carriers have been of foreign origin, while at the same time their proportion of the population has been only about three percent.

Hepatitis B infections that were acquired decades ago, as a result of the health care system of that time, are still detected in elderly people from time to time.

HEPATITIS C

Infection of injecting drug users

Based on directed seroepidemiological studies, in Finland practically all infections caused by the hepatitis C virus (HCV) are related to injecting drug use. Before the 1990s blood transfusions, primarily fresh blood transfusions, could transmit infections, but such cases were rare.

The infection is nearly always symptomless and therefore it is detected coincidentally, in connection with examinations performed for other reasons. The majority of patients develop a chronic infection, and sometimes it may lead to serious liver

disease even decades after becoming infected. Today a chronic infection can be treated with medication.

The data on hepatitis C infections registered in the National Infectious Diseases Register are based on laboratory diagnosis. Even though physicians are required to notify all cases, this is not always done. One reason may be that the treating physicians consider the detected cases old infections.

The number of registered cases has decreased steadily after the peak year 1997 (Figure 12).
At the same time the number of diagnosed hepatitis B and HIV infections has also decreased. These results confirm that virus infections related to injecting drugs have decreased markedly in Finland during the 2000s. In spite of this, relatively many cases are still detected in the youngest (15–24 years) age groups (Figure 13). This indicates that preventive measures directed to drug users do not optimally reach the youngest age groups or have the desired effect.

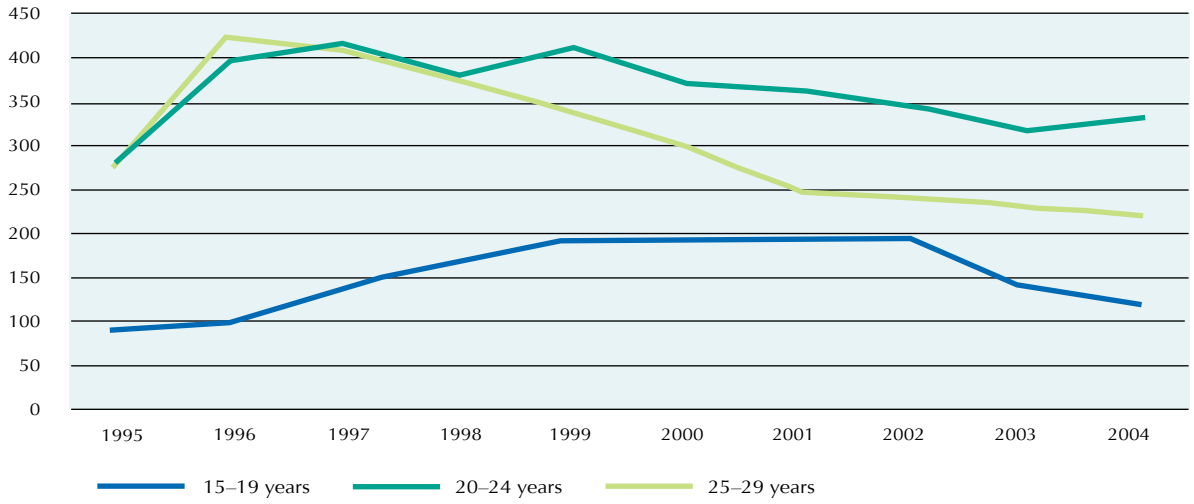
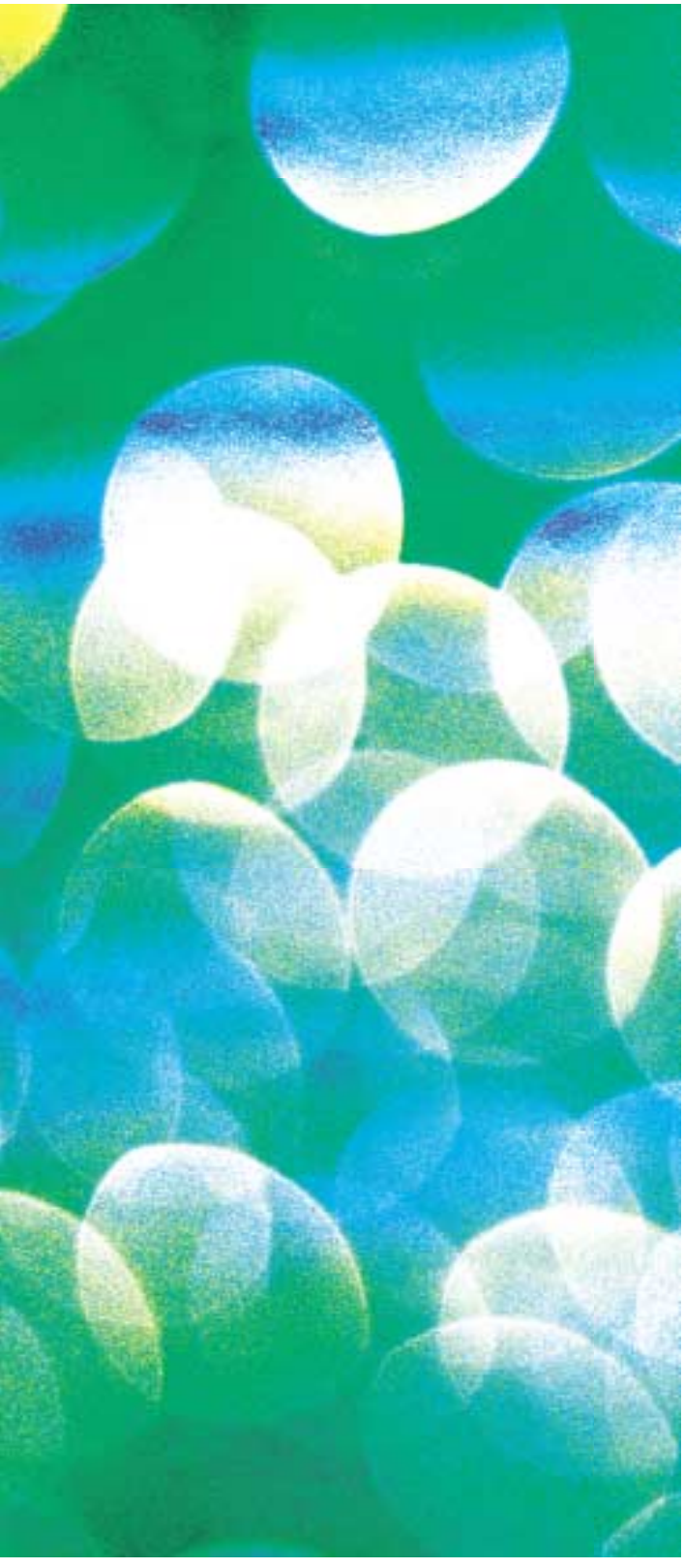


Figure 13. Hepatitis C in young adults 1995–2004.



SEXUALLY TRANSMITTED DISEASES

CHLAMYDIA – THE NUMBER OF CASES INCREASED AGAIN

The favourable declining trend of *Chlamydia trachomatis* cases in 2003 did not continue in 2004, as laboratories notified 13,357 new chlamydia cases, exceeding the previous year's figure by 494 cases. Especially in the hospital districts of Ahvenanmaa (354 cases/100,000 population) and Lappi (356/100,000) the incidence of chlamydia was clearly higher than in the country as a whole (257/100,000). Women constituted 60 percent of the cases (8,045). Under 20-year-old women constituted 34 percent and men 14 percent of all chlamydia cases. The highest number of cases was detected in the age group 20–24 years, both among men and women.

Since 1995, the surveillance of chlamydia has been based on notifications by laboratories. A new, more sensitive chlamydia test was introduced, based on gene amplification methods. The number of chlamydia cases increased every year from 1995 to 2002. In 1995, the number of notified chlamydia cases was 9,317 and in 2002 it was 13,661. The greatest increase was in 2002, when the number of cases increased by 12.5 percent from the previous year. The year 2003 was an exception to this increasing trend; 12,863 cases were notified then, which was 798 fewer than in the previous year. In 2004, there were 13,356 notified chlamydia cases. During the entire period the incidence of chlamydia has been highest in the hospital districts of Helsinki and Lappi.

Women constituted 61–63 percent of the diagnosed chlamydia cases. The highest number of cases was detected among 20-to-24-year-olds. Particularly the proportion of young cases has increased

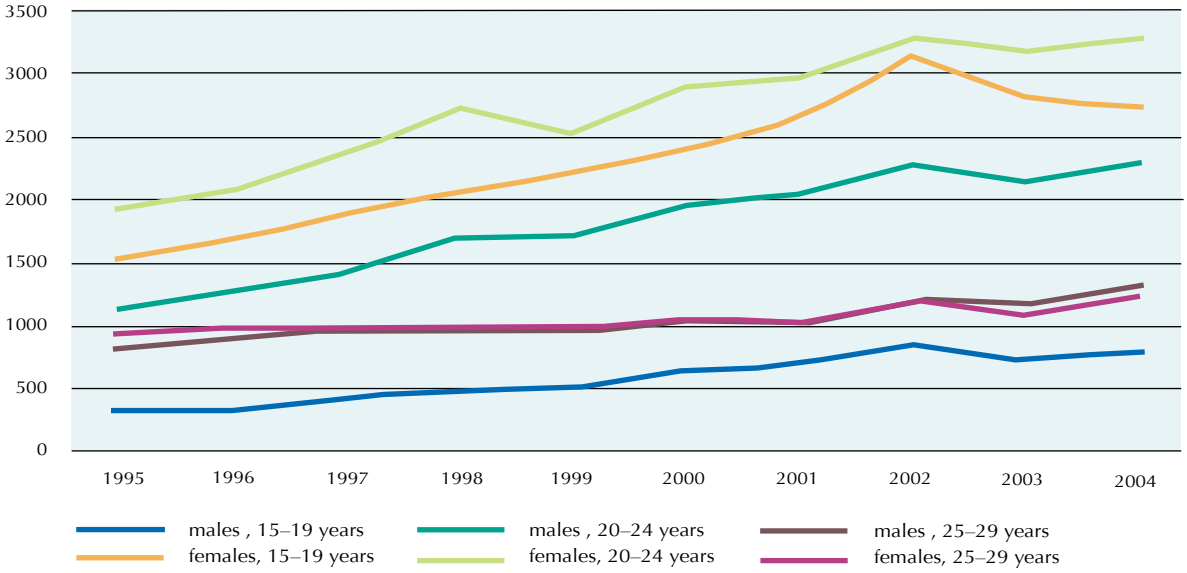


Figure 14. Chlamydia in the age groups of young adults 1995–2004.

(Figure 14). The proportion of under 20-year-olds has varied from 30 to 37 percent among women and from 10 to 15 percent among men.

The current laboratory notification system does not provide information on the country of origin. According to the data collected by the Sexually Transmitted Diseases sentinel surveillance system that includes the largest STD policlinics, the majority of chlamydia infections are of domestic origin. Less than 10 percent of chlamydia infections are contracted abroad.

GONORRHOEA – THE NUMBER OF GONORRHOEA CASES ALSO INCREASED

The number of *Neisseria gonorrhoeae* cases increased in 2004 from the previous year. There were 251 notified cases in 2004, and 200 (80%) of these were male. The incidence in the entire country was 4.8/100,000. The highest incidences of gonorrhoea cases were detected in the hospital districts of Helsinki and Uusimaa (8.6/100,000), Länsi-Pohja (7.5/100,000) and Ahvenanmaa (19/100,000).
The proportion of men's infections acquired abroad has decreased from 45 percent in the preceding year to 32 percent. Fifty-five percent of these infections were contracted in the Far East and now only 10 percent in Russia. Most strains of gonococci brought from the Far East are resistant to ciprofloxacin. The majority of women's gonorrhoea infections (90%) were acquired in Finland; there were only five cases contracted abroad.

In 1995–2004, the incidence of gonorrhoea has slowly decreased. The highest number of gonorrhoea cases was notified in 1995 (378 cases) and lowest in 2003 (189 cases). The number of notified cases was highest in Helsinki and in the hospital districts of Kymenlaakso, Etelä-Karjala and Pohjois-Karjala, due to the proximity of the eastern border. The majority of gonorrhoea cases were diagnosed in men (69–85%). Gonorrhoea patients are usually older than chlamydia patients. Gonorrhoea is rare among under 20-year-olds. Approximately half of men's infections have been contracted abroad. In 1996, Russia was the country of origin in 56 percent of all infections acquired abroad. Since then the proportion of cases with reported origin in the Far East has increased continuously. In 2001, infections contracted in Russia constituted 42 percent of all cases acquired abroad and 23 percent were

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

Table 7. Gonorrhoea infections acquired domestically and abroad 1995–2004.

contracted in the Far East, while in 2004 only 10 percent of such infections were from Russia and 55 percent from the Far East (Table 7).

In 2002, a local gonorrhoea outbreak was detected in the Päijät-Häme hospital district, caused by a ciprofloxacin-resistant strain of gonococci from Thailand. Gonorrhoea culture remains an important test method for enabling the surveillance of antimicrobial susceptibility.

SYPHILIS – MEN`S INFECTIONS MAINLY FROM RUSSIA

In 2004, there were 106 notified cases of *Treponema pallidum,* clearly fewer than in the preceding year. Fifty-five (52%) of the cases were diagnosed in men. Twenty-six percent of cases were over 70 years of age, but most of these cases involved serological scars due to previously treated syphilis.

The highest incidences were notified in the hospital districts of Helsinki and Uusimaa (4/100,000), Etelä-Karjala (4.6/100,000) and Etelä-Savo (4.8/100,000). Only 24 percent of men's infections were acquired abroad, most of these (46%) in Russia. The majority (82%) of women's infections were acquired in Finland.

In 1995–2004, the number of syphilis infections has decreased slowly. The highest number of syphilis cases was notified in 1996 (219) and the lowest in 2004 (105) (Table 8). There was a syphilis

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Domestically acquired infectionst	48	53	50	46	21	54	31	24	30	22
Infections acquired abroad	64	81	70	60	62	101	64	36	41	29
Russia	49	57	48	33	43	80	49	21	18	15
Estonia	5	11	5	5	3	3	2	1	6	1
Somalia	0	1	2	5	2	0	1	2	2	0
Thailand	1	0	1	4	0	1	1	0	1	2
others	9	12	14	13	14	17	11	12	14	11
Place of acquisition unknown	57	85	52	81	57	49	64	68	62	55
Total	**169**	**219**	**172**	**187**	**140**	**204**	**159**	**128**	**133**	**106**

Table 8. Syphilis infections acquired domestically and abroad 1995–2004.

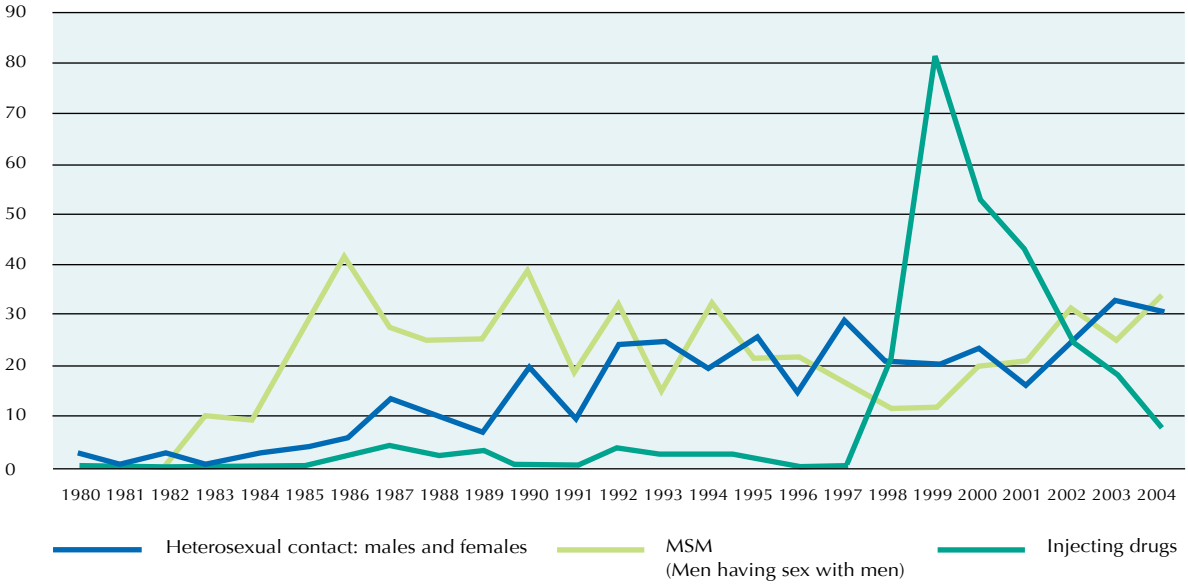


Figure 15. HIV cases detected among Finns in 1980–2004 in the major transmission categories.

outbreak in the Tampere region in 1995, but there have been no such outbreaks since then in Finland. Each year 10–27 percent of the infections were notified in patients over 70 years of age, but these cases were usually related to serological scars due to a previous syphilis infection. Men constituted 52–63 percent of diagnosed cases. The average age of syphilis patients was approximately 30–45 years.

The highest incidences of syphilis have been detected in the hospital districts of Etelä-Karjala, Pohjois-Karjala and Kymenlaakso, due to infections acquired in Russia. Of men's infections 58–75 percent were contracted abroad, usually in Russia. Women's infections were mainly acquired in Finland. Positive syphilis serology is detected every year in about ten pregnant women in the screenings performed by maternity clinics.

HIV AND AIDS – CASES CONTINUE TO DECLINE AMONG INJECTING DRUG USERS

In 2004, there were 130 new HIV infections detected in Finland. As regards HIV infections related to injecting drugs, the favourable trend continued in 2004: preliminary data show that only ten cases were associated with the use of injecting drugs (Figure 15). Compared with the epidemics in many of our nearby regions, the preventive measures directed at this risk group seem to have succeeded in Finland.

However, cases associated to sex between men have been slightly on the increase for several years (Figure 15).

HIV infections contracted in sex between men and women increased slowly, particularly among Finnish men (Figure 16). In 1980–2004 there were 1,754 HIV infections diagnosed in Finland, 74 percent of them in Finns.

Sex is the most common mode of transmission

Among Finnish HIV cases, infections acquired in sex between men still constitute the largest transmission category (42% of cases), the next largest category is sex between men and women (28%), and the third most significant category is injecting drug use (21%), despite the recent favourable development. Transmission from mother to child is very

rare. Since 1985 there have been no notified infections transmitted by blood products in Finland.

Hiv epidemic among injecting drug users 1998

Throughout the 1980s and during the first half of the 1990s only a few HIV infections associated with injecting drug use were diagnosed in Finland, in contrast to the other Nordic countries and all of Western Europe. Before 1998, only 27 sporadic cases had been detected (3% of all diagnosed cases), and none of these led to an outbreak. In 1998, an outbreak appeared among injecting drug users, and it peaked the following year. Eighty-five new infections were diagnosed then. When the outbreak appeared, control measures were started immediately: more health counselling centres with a broader spectrum of services for injecting drug users were established rapidly both in the capital region and elsewhere in Finland. At first the epidemic remained mainly in the capital region. The health counselling centres have yielded results: since 1999, the number of detected HIV infections associated with injecting drugs has decreased every year. In addition, seroepidemiological prevalence studies conducted at the health counselling centres indicate that the number of persons positive for HIV has remained low in this group. Subtype determinations have also shown that the majority of cases are still related to the HIV-1 CRF01-AE subtype that caused the original epidemic and is common in Southeast Asia (Figure 17). The A type that is common in this transmission category in East Europe has caused only four diagnosed infections in Finland. The subtype CRF06, common in Estonia, had not been detected in this transmission category by the end of 2004.

The number of infections associated with sex between men increased at first between 1985 and 1990 to its peak level so far, after which the annual number of cases stabilised and then decreased distinctly at the end of the 1990s, but began to increase again at the beginning of the 2000s. The trend in Finland is similar to that in Central Europe and North America. HIV-1 subtype B is dominant in the category of sex between men, and constitutes 95 percent of all cases in Finland (Figure 17). The limited distribution of subtypes indicates that this sub-

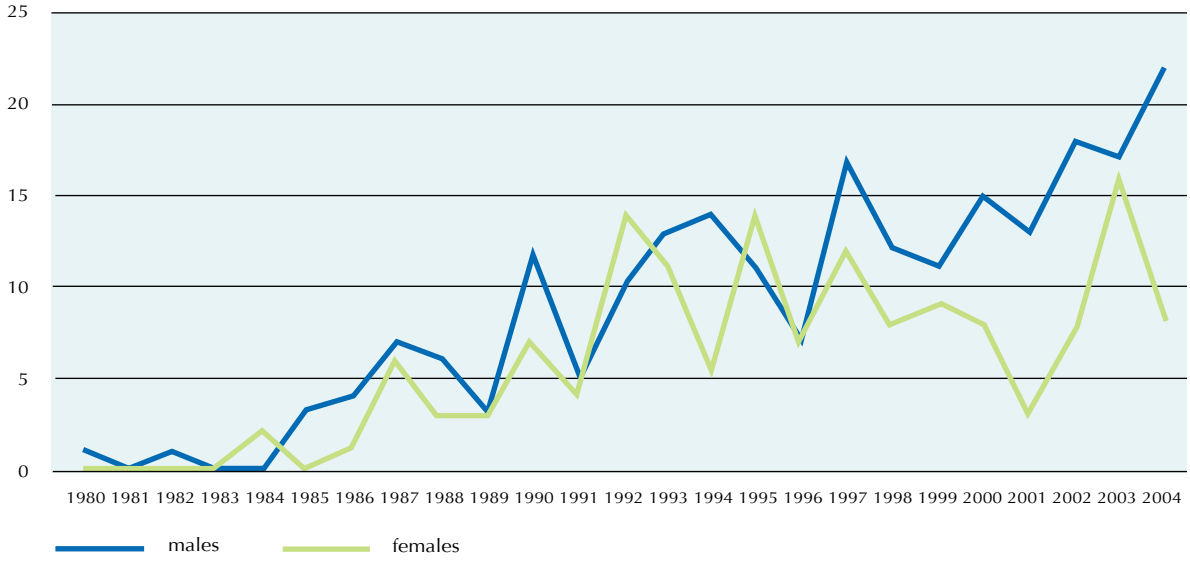


Figure 16. HIV infections acquired through sex between men and women in 1980–2004.

category of the Finnish epidemic is fairly homogenous.

Infections from heterosex are associated with travelling

As regards HIV infections acquired in sex between men and women, the number of male cases has grown year by year, while the number of cases among women has remained at the same level. A significant proportion of the cases are associated with travelling abroad, both among men and women. Sixty-six percent of typed strains among men are of some other subtype than the B common in the Western countries, and among women the corresponding figure is 70 percent (Figure 17). The most common HIV-1 subtype in this category is CRF01-AE (22% of cases), common in Southeast Asia, followed by the C (18%) and A (8%) subtypes. The CRF01-AE-Fin strain, originally related to injecting drugs, has been detected in 13 patients in this category. Only six patients in the category have been diagnosed with HIV-1 strains common in Eastern Europe. The subtype disribution supports the impression that a significant proportion of cases acquired in heterosexual contact is travel-related (Table 9).

Among cases diagnosed in foreigners, infections related to sex between men and women constitute the largest category (about 60% of cases), and the proportion of infections related to sex between men is relatively small, only about 13 percent. The percentage of infections transmitted from mother to child (the great majority before arrival in Finland) and the percentage of infections with unknown origin were higher than among Finns. Infec-

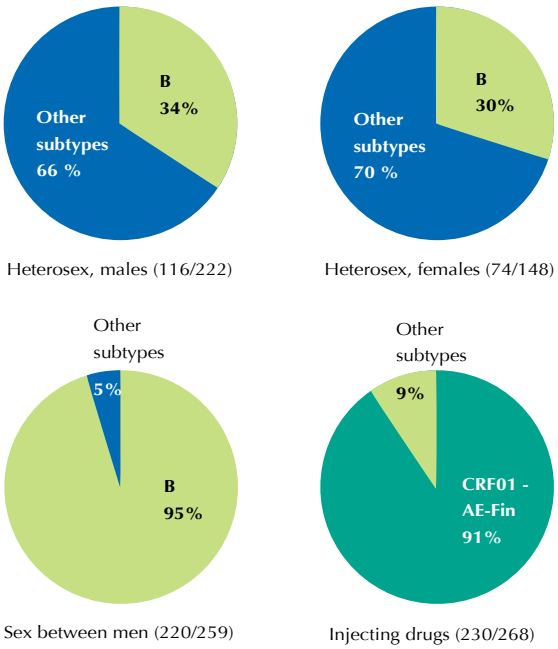


Figure 17. The HIV subtype distribution in the main transmission groups of Finnish cases between 1998-2004 (No. typed/total).

Year	Cases			Mode of transmission					
	Females	Males	Total	Homosexual contact	Heterosexual contact	Blood products	IV drugs	From mother to child	Unknown
1995	28	44	72	25	40	0	1	0	6
1996	20	49	69	23	36	0	1	0	9
1997	24	47	71	19	42	0	0	1	8
1998	32	49	81	13	32	0	20	0	16
1999	39	104	143	13	28	0	86	1	14
2000	51	94	145	23	43	1	56	2	18
2001	33	95	128	27	25	0	49	0	26
2002	37	94	131	38	41	0	27	3	22
2003	40	92	132	30	54	0	23	1	23
2004	25	104	129	44	53	1	10	1	20

* The latest transmission by blood products in Finland was detected in 1985.

Table 9. HIV cases by mode of transmission 1995–2004.

tions related to injecting drugs constitute a relatively lower percentage among the cases diagnosed in foreigners. It is remarkable that the HIV epidemics of these two groups, Finns and foreigners, really are separate from each other, and with a few exceptions hardly any infections are transmitted between the groups. In the group of foreign cases, other subtypes than subtype B are dominant. Foreigners' infections reflect almost solely the epidemiological situation in the country of origin.

AIDS – decreased mortality due to effective medication

Nineteen HIV-positive patients were notified to have developed aids in 2004. Among them, 15 infections had been transmitted sexually and four by injecting drugs. Four aids patients died. Compared with 1995, when 41 patients developed aids and 40 died, the numbers of patients developing aids and dying from it have decreased remarkably. The most important factor in this progress has been the availability of efficient HIV medication since the end of the 1990s.

MYCOBACTERIAL INFECTIONS

TUBERCULOSIS – THE NUMBER OF CASES CONTINUES TO DECREASE

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

The number of diagnosed tuberculosis cases in 2004 was 347 (Table 10), indicating a continuing decrease, by 16 percent from 2003. In 2004, there were 259 cases (75%) based on notification by both a physician and a laboratory, 44 cases (13%) based on laboratory notification only and 44 cases (13%) based on a physician's notification fulfilling the reporting criteria.

The favourable development of the previous decades continued in Finland, as the incidence of tuberculosis (Table 10) fell to one half between 1995 and 2004 (12.9 → 6.6/100,000). The fall is unusually fast for an industrialised country. Even though the incidence has decreased strongly in all age groups (Figure 18), the most significant change in the number of cases can be seen in the age groups of high incidence, i.e., the over-65-year-olds. This is due to the shrinking of the age groups that contracted an infection in their youth before the 1950s, predisposing them to reactivation of tuberculosis later in life. On the other hand, the small number of immigrants to Finland from countries of high incidence explains the small number of cases among the working-age population in comparison with most other industrialised countries where the percentage of immigrants among the population is clearly higher. Both physicians and laboratories are individually obliged to notify tuberculosis. The majority of

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	438	8,5	244	4,7	224	4,4	662	12,9	472	71,3
1996	432	8,4	241	4,7	213	4,1	645	12,5	510	79,1
1997	363	7,1	188	3,7	212	4,1	575	11,2	435	75,7
1998	396	7,7	201	3,9	233	4,5	629	12,2	491	78,1
1999	382	7,5	180	3,5	184	3,6	566	11,1	487	86,0
2000	370	7,2	228	4,4	167	3,2	537	10,4	451	84,0
2001	316	6,1	159	3,1	178	3,4	494	9,5	411	83,2
2002	297	5,7	137	2,6	177	3,4	474	9,1	392	82,7
2003	292	5,6	148	2,8	123	2,4	415	8,0	347	83,6
2004	235	4,5	128	2,5	112	2,1	347	6,6	289	83,5

Table 10. Incidence of tuberculosis in Finland 1995–2004.

the latter submit their notifications electronically to the National Infectious Diseases Register. It is highly unlikely that declining notifying activity could explain the decreased number of cases.

Diagnostic categories and proportion of infective patients

The proportion of culture-confirmed cases of all cases of tuberculosis registered in the National Infectious Diseases Register has varied over the years from 71 to 86 percent (Table 10). Since 1999 the proportion has remained stable. The proportion of culture-confirmed infections among the cases of pulmonary tuberculosis has been around 90 percent in recent years. The proportion of infective pulmonary tuberculosis with a positive sputum stain of all pulmonary tuberculosis cases has varied in 1995–2004, from 46 to 62 percent (54% in 2004), but no particular trend is visible in this proportion during this period.

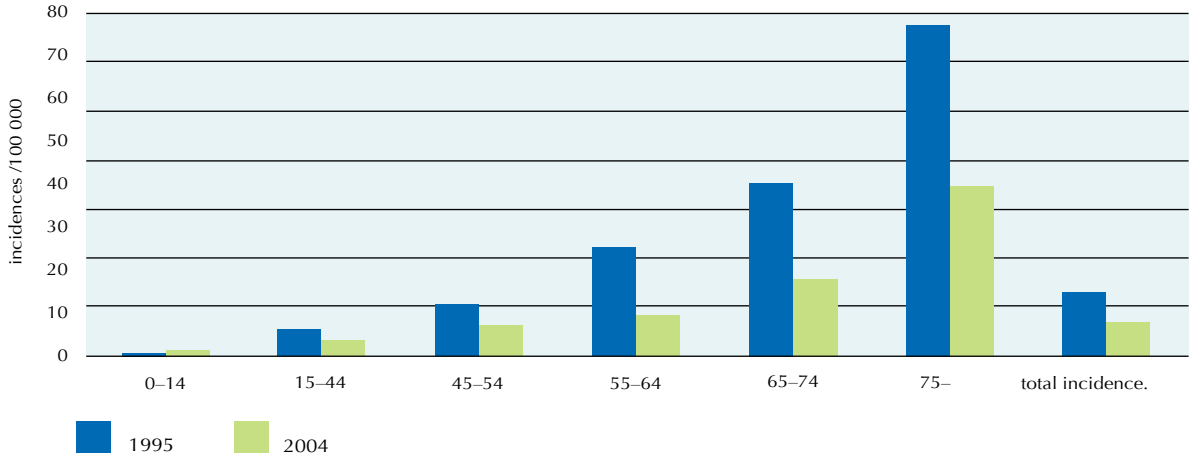


Figure 18. Incidence of tuberculosis by age group in 1995 and 2004.

Year	Pulmonary tuberculosis		Other tuberculosis		All cases	
	Cases detected in foreigners	Proportion of foreigners (%)	Cases detected in foreigners	Proportion of foreigners (%)	Cases detected in foreigners	Proportion of foreigners (%)
1995	25	5,7	12	9,4	37	5,6
1996	17	3,9	22	10,3	39	6,1
1997	22	6,1	23	15,1	45	7,8
1998	24	6,1	32	13,7	56	8,9
1999	25	6,5	20	10,9	45	8,0
2000	31	8,4	16	9,6	47	8,4
2001	38	12,0	28	15,7	66	13,4
2002	23	7,7	26	14,7	49	10,3
2003	37	12,7	13	10,6	50	12,0
2004	22	9,4	18	16,2	40	11,6

Table 11. Tuberculosis infections detected in foreigners 1995–2004.

Children

It is particularly difficult to confirm tuberculosis microbiologically in children under 15. Forty-four cases altogether were registered in the National Infectious Diseases Register for this age group (1995–2003 N=39, 2004 N=9), which gives an average of 4 cases per year throughout the ten-year period. Thirty (68%) of these cases were diagnosed in persons of foreign origin. In addition to the cases registered in the National Infectious Diseases Register, treating physicians have notified 0–8 cases a year detected in children under 15 (three cases per year on average) with such a strong clinical suspicion of tuberculosis that full anti-tuberculosis treatment has been decided on without microbiological confirmation of the diagnosis.

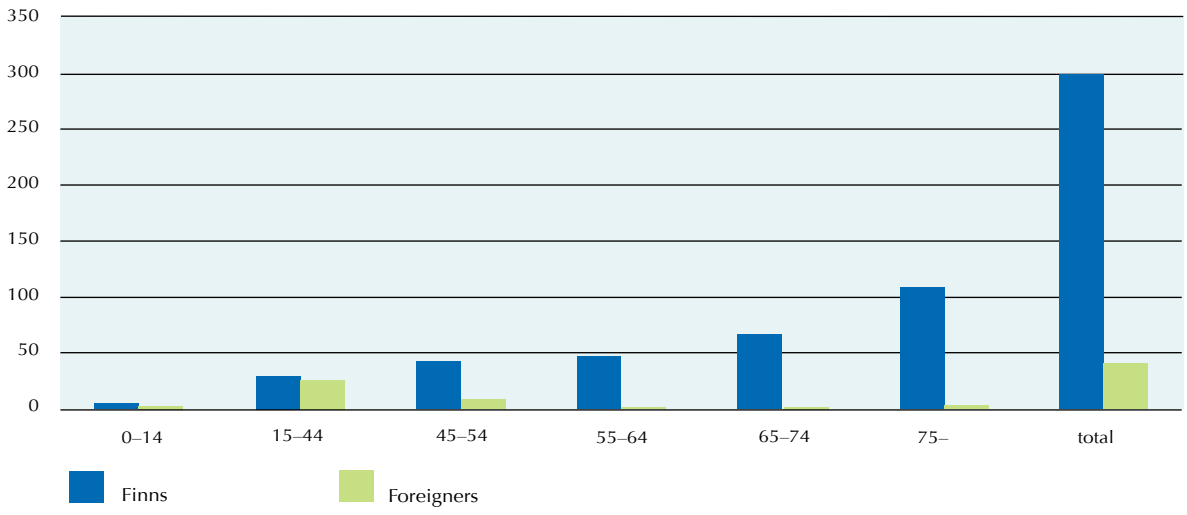


Figure 19. Infections in Finns and persons of foreign origin by age group in 2004.

Foreigners

The number of notified infections in foreigners (born abroad or a citizen of another country) did not increase in 1995–2004 (Table 11). While the number of Finns diagnosed with tuberculosis is rapidly decreasing, the proportion of foreigners among all notified cases has nearly doubled. In 2004, thirty-five (88%) of the notified cases in foreigners were diagnosed in patients under 55 years of age (Figure 19). Most of the notified foreign cases have their origins in countries with a high incidence of tuberculosis. In 1995–2004, forty-seven percent of foreign tuberculosis cases originated from Africa, 29 percent from Asia and 14 percent from the area of the former Soviet Union.

Multidrug resistant strains

As regards the antimicrobial susceptibility of *Mycobacterium tuberculosis* strains, the situation has remained good in Finland, even though strains resistant to both isoniazid and rifampicin, ie multidrug resistant (MDR), strains are common in Russia and Estonia. No multidrug resistant strains were notified in 2004; in the previous years the number has been 2–4 per year (0.4–1.0%).

Molecular epidemiology of tuberculosis in Finland 2000–2004

Molecular epidemiology typing of *Mycobacterium tuberculosis* strains is an essential part of tracing the transmission routes of tuberculosis. The Mycobacterial Reference Laboratory of the National Public Health Institute collects all new *M. tuberculosis* strains as part of the strain collection maintained by the National Infectious Diseases Register.

Finland's *M. tuberculosis* strains have been tested systematically by internationally standardised typing methods (IS6110 RFLP and spoligotyping). Altogether 1,876 strains were tested in 2000–2004. The results indicate that about 40 percent of Finnish cases belong to clusters. The size of the clusters varied from 2 to 38 cases/cluster, the median being two cases. Belonging to a cluster usually means a fresh infection and epidemiological connection between the cases. The infection can also be due to reactivation of a formerly common strain in an aging person, which is not uncommon in Finland.

Eleven fresh TB infection clusters of more than ten cases were detected. The largest of these is a cluster of 38 cases, the first of the cases a dog that in turn transmitted TB to its owner. Most of the other patients in the cluster were homeless men from Helsinki. The only obvious connection between the dog and the homeless men was an outdoor area that all of them visited. This TB strain has also spread to other parts of Finland, but the spreading seems to have stopped for the time being, as new cases were no longer detected in 2004.

Genotyping has revealed five laboratory contaminations. These involved 36 persons altogether. Six of them had strongly positive samples as the source of cross-contamination to the cultures of 30 other persons. As the contaminations were revealed, unnecessary treatments and tracing of infections were avoided.

Typing has also revealed that strains of the so-called Beijing group, common in the nearby regions, are rare in Finland. These *M. tuberculosis* strains spread faster, and they are often MDR strains. About two percent of Finnish strains belong to the Beijing group, and only a few of them have been MDR strains. So far there have been no outbreaks caused by an MDR-TB strain in Finland.

BCG

The *Mycobacterium bovis* BCG bacterial strain is a strain attenuated for vaccination, derived from the bacterial species *M. bovis* belonging to the *M. tuberculosis complex*. Adverse effects caused by the BCG vaccine in the vaccination programme in-

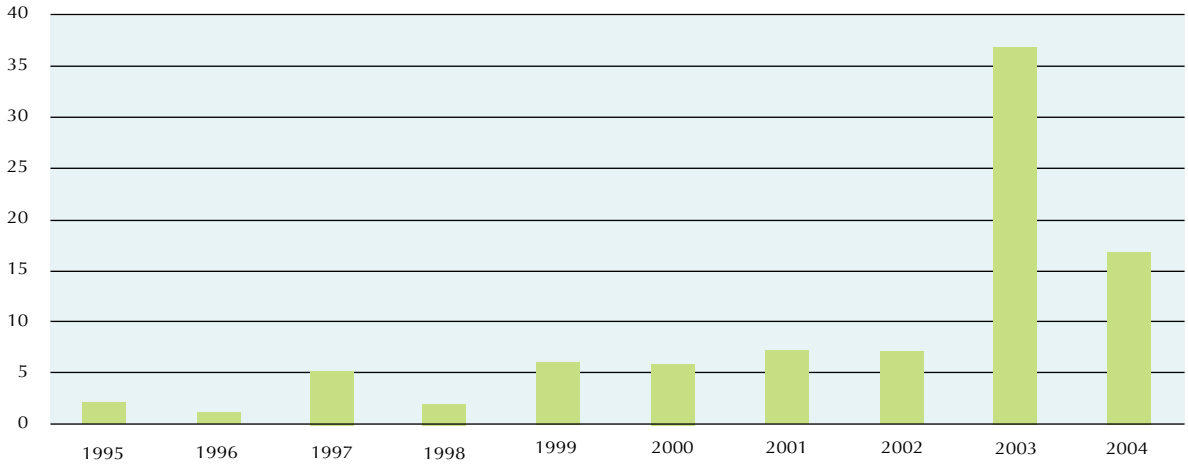


Figure 20. *M. bovis* BCG -infections 1995–2004.

creased after switch of the source of the vaccine in August 2002. This was reflected as a rise in the number of *M. bovis* BCG findings notified to the National Infectious Diseases Register (Figure 20). Nearly all findings were obtained from lymph node samples. In 2004, the number of notified findings decreased clearly. A similar trend was seen in the number of BCG vaccination-related adverse effects notified to the National Public Health Institute. The number of cases peaked in 2003 and decreased the following year. Similar increases of adverse effects after changing a vaccine have been reported before. The findings notified by laboratories also include findings related to local treatment of bladder cancer with *M. bovis* BCG bacterium.

Mikrobe	Findings	Proportion
Mycobacterium avium	1360	34 %
Mycobacterium gordonae	943	24 %
Mycobacterium intracellulare	398	10 %
Mycobacterium fortuitum	219	6 %
Mycobacterium malmoense	170	4 %
Mycobacterium chelonae	86	2 %
Mycobacterium terrae	69	2 %
Mycobacterium avium complex	46	1 %
Mycobacterium peregrinum	39	1 %
Mycobacterium abscessus	35	1 %
Mycobacterium marinum	29	1 %
Mycobacterium xenopi	27	1 %
other atypical mycobacteria	540	14 %
Total	**3961**	**100 %**

Table 12. The most common findings of atypical mycobacteria 1995–2004.

ATYPICAL MYCOBACTERIA

Laboratories also notify the findings of atypical mycobacteria to the National Infectious Diseases Register. In 1995–2004, *M. avium* was clearly the most common finding notified, constituting more than a third of all findings (Table 12). More than 100 cases of *M. gordonae, M. intracellulare, M. fortuitum* and *M. malmoense* were also notified during this period. There was no significant annual variation in the distribution of the most common species. The virulence of this group of bacteria varies. Usually they cause so-called opportunistic infections in persons with impaired immunity.

ANTIMICROBIAL RESISTANCE

MRSA – THE SITUATION CONTINUED TO DETERIORATE

The number of infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA) continued to increase in 2004. Now this development manifested in severe systemic infections for the first time. Nearly 1,500 MRSA cases were notified to the National Infectious Diseases Register. The hospital districts of Helsinki and Uusimaa, Pirkanmaa and Pohjois-Pohjanmaa had the highest numbers of cases. Incidence per 100,000 population was highest in the hospital districts of Pirkanmaa, Helsinki-Uusimaa and Satakunta (Figure 21).

MRSA increased particularly among the elderly. In recent years the proportion of over 74-year-olds has been nearly half of all cases. Even though MRSA was rare in children (<6% of cases), the number of infections among children under 1 year of age increased, too (Figure 22).

KTL confirms and types all MRSA strains

KTL's Laboratory of Hospital Bacteriology confirms and types all MRSA strains in Finland. In 2004, more than 1,700 strains were tested, which is one third more than in 2003. Approximately half of the confirmed MRSA infections were caused by two multiresistant epidemic strains (Töölö and Bel EC-3 epidemic strains). Other epidemic strains detected in previous years (Kokkola, Kemi and Mikkeli clones) were also common in many hospital districts.

Findings in blood

There were 32 MRSA findings from blood, and three were from cerebrospinal fluid. Previously

there has been only one MRSA finding from cerebrospinal fluid, in 1998. In 1995–2003, MRSA findings from blood were sporadic, and the proportion of methicillin-resistant *Staphylococcus aureus* findings from blood remained below one percent. Now the proportion of MRSA strains among *S. aureus* findings from blood rose above 2.5 percent (Table 13).

One third of the MRSA findings from blood occurred in the hospital district of Helsinki and Uusimaa. It is also of importance to note that the total number of *S. aureus* findings from blood increased by nearly 70 percent from 1995 to 2004 (from 12 to 20 cases per 100,000 population). Most of the increase occurred among adults, with emphasis on the oldest age groups.

S. aureus is a typical cause of hospital infections. In the hospital infection surveillance programme SIRO, *S. aureus* was the second most common microbe in 1999–2003 in both blood culture positive hospital infections (11%) and surgical site infections (18%), but hospital infections caused by MRSA were rare. Among blood culture positive

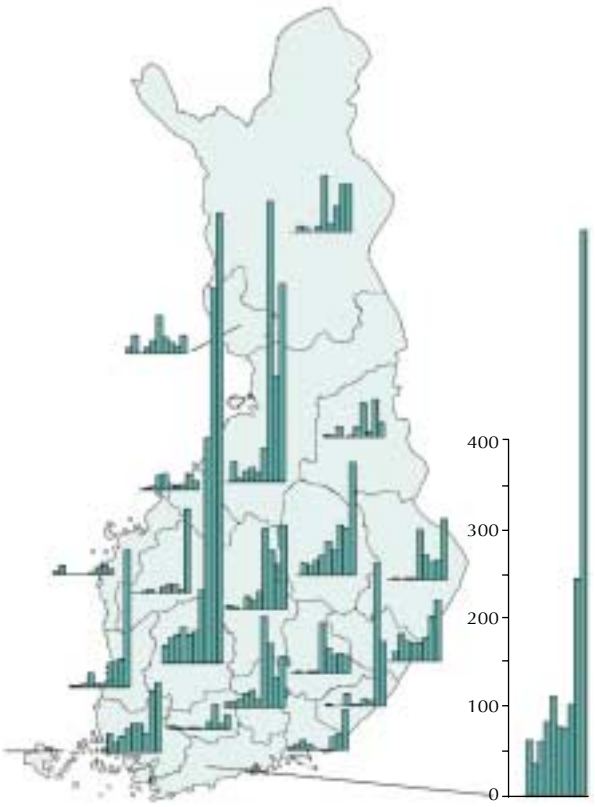


Figure 21. MRSA cases by hospital district 1995–2004.

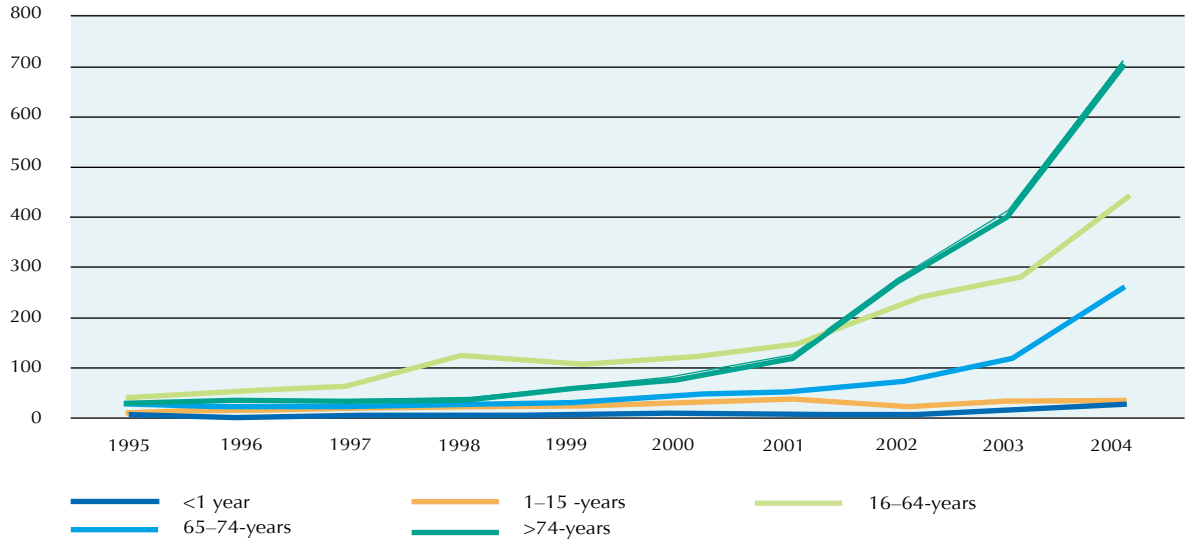


Figure 22. Age distribution of MRSA cases 1995–2004.

Year	All MRSA-findings	*S. aureus* blood culture findings	MRSA blood culture findings and the meticillin resistance of *S. aureus* (%)
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)
Total	**4227**	**8329**	**76 (0,9)**

Table 13. MRSA findings and their proportion of *S. aureus* blood culture findings 1995–2004.

infections caused by *S. aureus* the proportion of MRSA was one percent (5/437) and in surgical site infections three percent (4/128).

New guidelines for control in 2004

In summer 2004, a Finnish group of experts completed revised guidelines for the control of MRSA infections in health care institutions. The guidelines are intended to help infection control teams in hospital districts and institutions in planning and implementing control measures against MRSA. The guidelines (in Finnish) are available in pdf form on KTL's website at http://www.ktl.fi/attachments/suomi/osastot/infe/julkaisut/mrsa2004.pdf

VRE

The number of findings notified to the National Infectious Diseases Register in 2004 was only 14, which is at the same level as in 2001–2003. No VRE findings were made from blood or cerebrospinal fluid. More than 80 percent of all VRE notifications in 1995–2004 came from the hospital district of Helsinki and Uusimaa, particularly in the years 1996–2000 (VRE outbreaks in the capital region). VRE clusters with approximately ten cases each occurred in the Vaasa hospital district in 1999–2000 and in Pohjois-Pohjanmaa in 2004. Some sporadic VRE findings were made annually in the hospital district of Varsinais-Suomi. In 1995–2004, there were altogether only four VRE findings from blood (and none isolated from cerebrospinal fluid).

In 2004, KTL's Laboratory of Hospital Bacteriology confirmed a total of 18 new VRE cases by bacterial typing. Epidemic VRE strains of vanB type *Enterococcus faecalis* and vanB type *E. faecium* species were detected in Pohjois-Pohjanmaa (11 cases altogether); the rest of the VRE strains of *E. faecium* species, detected in different parts of Finland (7 cases altogether), were different from each other. Five different epidemic VRE strains and a number of sporadic VRE strains have been identified in Finland by bacterial typing in 1996–2004.

PNEUMOCOCCUS

Invasive pneumococcal disease – susceptibility of pneumococcus to macrolides and penicillin

The incidence of invasive *Streptococcus pneumoniae* disease was approximately 10 cases per 100,000

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	8,0	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

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

Table 14. Antimicrobial resistance of *Streptococcus pneumoniae* findings in blood and CSF 1998–2004.

population in 1995–2002. In 2003, the incidence rose by a third (13/100,000 population). The incidence rose in all age groups, and it was associated with the strong influenza A epidemic that occurred at the end of the year. In 2004, the incidence remained at the same level as in 2003.

The proportion of pneumococci resistant to macrolides was about six percent in 1999, but it has subsequently risen rapidly. In 2003, the proportion of macrolide-resistant strains was already more than 20 percent. Resistance to macrolide was more common among children than adults (31% vs 18%). Previous studies have already shown that the resistance of pneumococci to macrolides is associated with the increased consumption of macrolides. The use of macrolides has increased considerably in Finland in recent years, which may be the reason behind the increased resistance.

The proportion of strains with reduced susceptibility to penicillin (MIC 0.125-<2 mg/L) also grew. They were most common in children under two years of age (12%). The proportion of penicillin-resistant (MIC ≥2 mg/L) strains remained below three percent. These strains were most common in those aged 65 or more (4%) and least common in children under two (less than 1%). In 1999, no multiresistant pneumococcal strains were found yet. In 2000, their proportion was more than one percent, and in 2001–2004 it varied between 4 and 6 percent. Multiresistant pneumococcal strains were detected in all age groups, but their proportion was highest among children under two (6%) and among cases aged 65 years or more (6%).

The most common pneumococcal serotypes causing invasive infections were 14, 4, 9V, 3, 23F and 7F. In 2002–2004, these serotypes caused approximately half of all invasive pneumococcal infections. During these years the distribution of serotypes has remained almost unchanged. Resistance to macrolides and penicillin was detected particularly in serotypes 14 and 9V. Resistance to macrolides was also common in serotypes 19A, 6B, 7F and 19F. With the exception of serotype 7F, these serotypes also often showed reduced susceptibility to penicillin. Most multiresistant strains were of serotype 14 (Table 14 and 15).

Serotype	Pneumococcal strains	Erythromycin(%)	Penicillin (I+R) (%)	Multidrug resistance (%)
14	289	55	33	144
4	252	6	2	1
9V	172	39	16	2
3	162	2	2	<1
23F	141	9	6	2
7F	132	2	3	<1

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

Table 15. The most common *Streptococcus pneumoniae* serotypes and their antimicrobial resistance 2002–2004.

The situation in Finland the worst among the Nordic countries

The European Antimicrobial Resistance Surveillance System EARSS, launched in 1999, http://www.earss.rivm.nl, collects antimicrobial susceptibility data on only invasive microbe isolates: *S. aureus, E. coli* and enterococci from blood and pneumococci from both blood and cerebrospinal fluid. In 1999–2004, nine to fifteen FiRe laboratories http://www.ktl.fi/extras/fire out of Finland's 28 clinical microbiology laboratories participated in EARSS. The susceptibility results for *S. aureus* and enterococci were very similar to the data in the National Infectious Diseases Register. Signs of the deteriorating MRSA situation could already be seen in the EARSS report in 2003, as the proportion of methicillin-resistant strains exceeded one percent (1.4%, 10/727). In 2004, the proportion of probable extended-spectrum -lactamase-producing strains (ESBL) of all *E. coli* strains rose above one percent for the first time, and the proportion of strains resistant to fluoroquinolones was seven percent. From 1999 to 2004 the resistance of pneumococcus to macrolides rose from six to nineteen percent.

Overall, the antimicrobial resistance situation in Finland is worse than in the other Nordic countries and the Netherlands as regards the invasive microbial pathogens mentioned above, but better than the situation in Central and Southern Europe. The most significant changes in recent years have been taking place in the MRSA situation, the susceptibility of pneumococci to macrolides and the emergence of invasive ESBL strains

OTHER INFECTIONS

HIB – VACCINE PROVIDES GOOD PROTECTION

In 2004, the National Infectious Diseases Register received notifications on 27 cases of serious infections caused by the *Haemophilus influenzae* bacterium, detected from blood or cerebrospinal fluid. *Haemophilus influenzae* type b caused disease only in one elderly patient.

The other infections were also detected mainly in adults; only three of the cases belonged to the age group 0–14 years.

Children born in 1985 and later have received Hib vaccination since 1986 at the healthy child clinics at the age of four, six and 14–16 months. Only a few years after the vaccinations began, the number of Hib cases decreased from hundreds to a few cases per year. At the beginning of the 2000s there were years when no cases at all were diagnosed in the vaccinated age groups, while in some years sporadic cases were detected among those who had received a partial or full series of vaccinations.

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 efficacy of the vaccination is monitored closely, and information on vaccinations is investigated on all children in the age group vaccinated who have been diagnosed with Hib (Table 16).

MENINGOCOCCUS – NO VARIATION IN THE NUMBER OF CASES

The number of *Neisseria meningitidis* cases notified to the National Infectious Diseases Register has varied very little (42–58 cases/year) since 1997, and the incidence has been low (0.8–1.1/100,000).

In 1995 and 1996, there were 78 and 79 cases, with incidences of 1.52 and 1.53/100,000, respectively. A strain was sent to the National Public Health Institute in more than 90 percent of the notified cases. The majority of cases were caused by group B meningococci. Fewer than ten group C strains per year were detected in 1997–2004, which was also the case with group Y strains. Group W135 strains began to appear after the turn of the millennium.

An infection cluster caused by group B meningococcus, a strain of subtype B:15, emerged in 1994 causing concern. The cases were conscripts from the Parola and Riihimäki garrisons and persons who had been in close contact with them. In addition, group C meningococci findings were more abundant than usual in these years (Table 17). The group C pathogens represented different strain types. About half of these cases were detected in the province of Western Finland. B:2b was the third subtype that increased at the same time. After 1996 the number of cases decreased for both group B and group C.

Most meningococcal infections occur among small children and young adults. There have been 10–20 cases per year among children under 15. A rising incidence in older age groups has been regarded as a sign of an early stage of a possible epidemic. In 1995 and 1996, the increase in cases was to a great extent due to an increased number of cases in adults; in these years 30 and 32 cases, respectively, were notified in 15–24-year-olds, and after that 8–19 cases per year.

The clusters in 1995–1996 increased the incidence in the provinces of Southern Finland and Western Finland (1.3–2.2/100,000). After this, cases have been detected evenly all over the country with the exception of Lapland, where the incidence in 1998, 1999, 2003 and 2004 was about twice as high as in the rest of Finland (2.01–2.13/100,000). In Åland there was only one diagnosed meningococcal infection during the entire period, in 1995.

Judging by the subtyping results, group B meningococcal strains have been very heterogeneous in Finland. With few exceptions, the subtypes of the strains have been very different, and only four group B subtypes were detected in at least three strains per year during several years. The proportions of types B:4 and B:4:4 varied throughout the surveillance period. The B:2b subtype strains common in the 1990s have been rare in the 2000s. The B:15 subtype that caused the 1995–1996 cluster was detected in 1999 and 2000 only in three cases altogether. After this the B:15 strains have increased again so that in 2001–2004 a total of 21 strains were

		Haemophilus influenzae type b cases				All Haemophilus influenzae cases
Year	Hib cases	Vaccinated cases	Age 0–4 years	Age 5–15 years	Age > 15 yeras	
1995	6	2	1	2	3	13
1996	5	-	-	-	5	21
1997	2	1	-	2	-	17
1998	4	-	2	-	2	32
1999	7	3	2	1	4	32
2000	2	2	2	-	-	37
2001	4	-	-	-	4	49
2002	4	-	-	-	4	26
2003	8	4	4	2	2	36
2004	1	-	-	-	1	27

Table 16. Invasive Hi and Hib cases 1995–2004.

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	-	59	15	3	-	2	79
1998	-	44	7	2	-	1	54
1999	-	35	9	8	1	4	57
2000	-	30	11	2	3	2	48
2001	-	34	9	4	1	3	51
2002	-	36	6	4	1	2	49
2003	-	28	5	7	-	2	42
2004	-	32	5	4	2	4	47

Table 17. Meningococcal infections by serogroup 1995–2004.

detected. Most of the cases were young adults particularly in the Häme region. It seems that the subtype that caused the cluster in 1995–1996, is still going around in Finland.

MMR – VACCINE PROVIDES GOOD PROTECTION

Measles, mumps and rubella (the MMR diseases) were eradicated from Finland by the mid-1990s due to a successful MMR vaccination programme. Endemic cases have not been detected in our country since then. Laboratory-confirmed cases in 1995–2004, fewer than 10 per year for each of these diseases, have been imported into Finland by travellers. All cases have been non-vaccinated. In 2004, only one case of mumps was detected, imported from Somalia, but not a single case of measles or rubella. Over the years the National Infectious Diseases Register has received a number of notifications of suspected MMR cases that confirmation tests and investigations have revealed as post-vaccination antibody rises or cross reactions, etc., instead of real cases.

WHO has set strategic objectives to eliminate measles and control rubella (<1 congenital rubella infection /100,000 births) by 2010 in the European region. In order to achieve these objectives, the proportion of children having received at least one dose of measles-rubella vaccine should exceed 95 percent. In addition, the proportion of women in childbearing age having received rubella vaccination should be >90 percent. In order to achieve mumps control the vaccination coverage should also exceed 90 percent. Finland has achieved all these objectives. Since the end of the 1980s the MMR vaccination coverage has exceeded 95 percent.

Seroepidemiological studies have shown that at the end of the 1990s, 2.7 percent of under 10-year-olds, 2.1 percent of 10–20 year-olds, 1.4 percent of 20–40-year-olds and less than one percent of over 40-year-olds were negative for measles antibodies. As regards rubella, only 1–4 percent of all under 40-year-olds were seronegative, while the proportion of those negative for mumps antibodies was somewhat higher.

As part of the campaign to eradicate measles, the occurrence of different viral strain types is monitored globally by WHO's measles-rubella reference laboratory network. Some strains of MPR viruses imported into Finland from different parts of the world in the past ten years have been identified genetically to belong to a common subtype in

their region of origin. These imported cases have not spread, which proves that the protection level is still sufficient in Finland. The eradication of MMR diseases succeeded in Finland due to high vaccination coverage.

The atypical, often milder-than-usual-disease forms occurring in the vaccinated may complicate the confirmation of suspected infections. A low-threshold approach in taking samples as early as possible and sending them to a laboratory for confirmation guarantees reliable surveillance of MMR diseases in the future as well.

EPIDEMIC NEPHROPATHY – PEAK INCIDENCE FROM AUGUST TO DECEMBER

In 1994–2004 there were nearly 14,000 notified cases of epidemic nephropathy caused by the Puumala virus. Sixty-three percent of the patients were male, and 80 percent were 25–64 years old. The incidence of epidemic nephropathy among 25–44-year-old men is twice as high as among women in the same age group. Among those over 65 years of age the incidence was equally high among men and women.

There is seasonal variation in the incidence of epidemic nephropathy, with the highest number of cases occurring in December each year. Another incidence peak in 1995–1997 could be seen in August. In addition, in the winters of two consecutive years there are more cases than in the third year. This yearly and seasonal variation has been associated with the three-year cyclical variation of the bank vole population density, and on the other hand with bank voles seeking their way to houses and sheds early in the winter, which increases the likelyhood of Puumala virus exposure for humans.

A particularly high number of cases was diagnosed in December 1998, December 1999, December 2001, November 2002 and December 2004. In these years the total number of cases exceeded

1,300 while, for example, there were fewer than a thousand cases in total in 1995–1997. The incidence was also low in 2000, with no increase even toward the end of the year. After two peak winters in 2001 and 2002 the incidence remained high almost throughout 2003, and no separate peak was seen in December 2003. In 2004, nearly 1,500 cases of epidemic nephropathy were notified, and the incidence peaked again in December.

The regions with a high incidence of epidemic nephropathy may vary from year to year depending on the bank vole population density. The incidence has almost always been highest in the hospital district of Etelä-Savo or Itä-Savo (Figure 23). In 2004,

Figure 23. Average incidence of Puumala virus cases by hospital district 1995–2004.

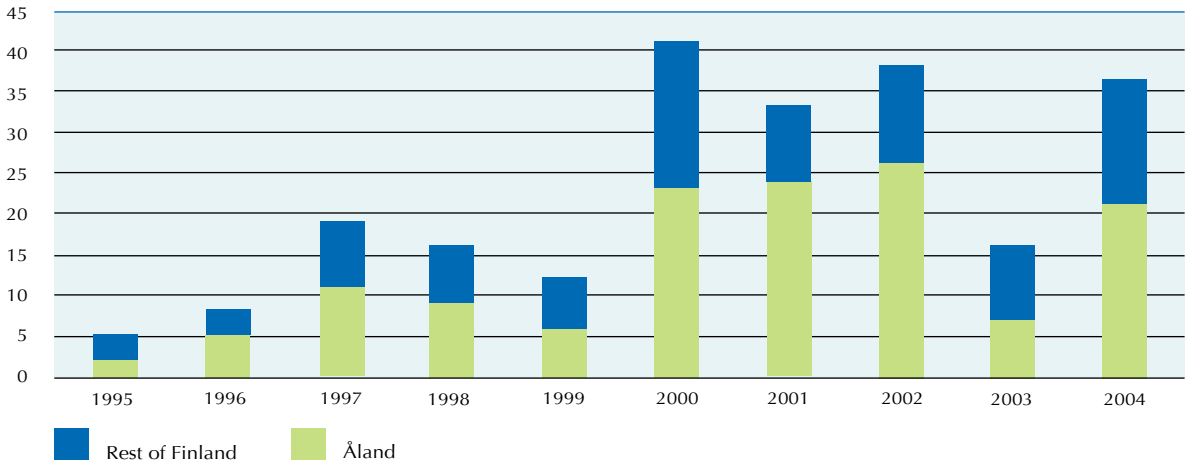


Figure 24. Tick-borne encephalitis (TBE), Åland and rest of Finland 1995–2004.

the incidence was highest in the hospital district of Itä-Savo (122/100,000 population).

TBE – PRIMARILY IN ÅLAND

The number of tick-borne encephalitis (TBE) cases has increased since the 1990s almost everywhere in the Baltic Sea region, and this is also the case in Finland (Figure 24). The development is considered to be due to the change of climate, which has facilitated the circulation of the virus in tick populations. In Finland the disease has been traditionally endemic for Åland, and cases have also been detected in restricted areas on the south, southwest and west coast of Finland. There is an efficient vaccination available, and experts have suggested that it should be taken into general use in Åland. At the moment the vaccination is only administered to people who are considered to have an exceptionally high risk of becoming infected due to the nature of their work or free time activities.

Figure 25. Average incidence of tularemia cases by hospital district 1995–2004.

TULAREMIA – FOUR TULAREMIA OUTBREAKS DURING THE SURVEILLANCE PERIOD

In 2004, the National Infectious Diseases Register received 151 notifications of microbiologically confirmed cases of *Francisella tularensis* (incidence 2.9/100,000 population/year). The cases were 5–84 years old (median 50 years), and 55 percent were males. The incidence in 2004 was average with respect to the entire surveillance period – normally approximately a hundred cases per year are notified (incidence 1–2 cases/100,000/year). The majority of cases were diagnosed between July and October in North and South Pohjanmaa and Central Finland in areas where tularemia has traditionally been endemic (Figure 25). In recent years, however, there have been signs that the geographical region endemic for tularemia incidence is expanding to the south. Large tularemia outbreaks have occurred in 1995 (467 cases), 1996 (397 cases), 2000 (926 cases) and 2003 (823 cases). The ulceroglandular form of tularemia is mainly transmitted by insect bites. Clusters of the pulmonary form of tularemia have been detected in connection with large outbreaks, and these cases have been associated to inhaling hay dust during harvesting.

POGOSTA DISEASE – FEWER CASES IN 2004 THAN BEFORE

In 2004, the National Infectious Diseases Register received 40 notifications of microbiologically confirmed Sindbisvirus cases (incidence 0.8/100,000 population/year). The cases were 11–76 years old (median 52 years), and 75 percent were female. In 2004, the number of notified cases was clearly lower than in the preceding years: In 2003, there were 211 notified cases and in 2002 as many as 597. Most of them were detected in August–September in Eastern Finland in regions where Pogosta disease is traditionally endemic (Figure 26). The first Pogosta disease outbreak was detected in Finland in 1974, after which outbreaks have recurred every seven years.

Extensive Pogosta disease outbreaks raged in 1995 (1,310 cases) and 2002 (597 cases). The outbreaks recurring every seven years may be associated with local ecological factors and the cyclical variation of available host animal populations (forest game birds) or vectors. Sindbisvirus is assumed to be transmitted mainly by insect bites.

LYME DISEASE – HIGH INCIDENCE IN 2004

The incidence of Lyme disease was exceptionally high in 2004. A record-breaking total of 1,135 new cases were notified in Finland.

Figure 26. Average incidence of Pogosta disease cases by hospital district 1995–2004.

Åland has a very high incidence Lyme disease internationally – in 2004 there were 477 notified cases (1,817/100,000 population), which indicates an increase of about 75 percent from the previous year and represents more than 40 percent of all cases in the whole country. In the rest of Finland the number of notified cases increased by 20–50 percent from the previous year. In proportion with the population, in 2004 the number of new notified borreliosis cases in the province of Southern Finland was more than double (19/100,000) the number of cases in the province of Western Finland (8/100,000 population). In 2004, the incidence peaked in August–November.

Increasing incidence with Åland in the lead

The incidence of Lyme disease has increased during the ten-year-period. In 2004, the incidence was exceptionally high, which was probably due to the very rainy summer.

The incidence is about 17 cases per 100,000 population per year. Åland is by far in the lead as regards incidence, with an average of 1,343/100,000 population per year in 2000–2004 (increase 3% compared with 1997–1999). Åland's proportion of all cases notified in Finland was 40 percent during the latter half of the ten-year-period, while it was 18 percent during the first half. In continental Finland, in the province of Western Finland the average incidence was 14 notified cases/100,000 population per year in 2000–2004 (increase 72% percent in comparison with the years 1997–1999). In the province of Southern Finland the average incidence in 2000–2004 was 7 cases/100,000 population per year (increase 3% from the years 1997–1999). In the province of Eastern Finland the incidence has increased less rapidly than elsewhere in Finland, and in 2000–2004 the average incidence was 13 cases/100,000 population per year (increase 32% from the years 1997–1999). During the latter half of the ten-year-period the incidence was higher in Southern and Western Finland than in Eastern Finland, while during the first part of the period the incidence was clearly higher in Eastern Finland compared with the provinces of Southern and Western Finland. In the province of Oulu there have been just over ten cases per year, and a couple of cases a year have been notified in the province of Lapland.

Throughout the ten-year surveillance period the incidence has usually peaked in September, except in 1996 (August), 2001 (August) and 2003 (October). In November the incidence has always been higher than in June – sometimes even more than twice as high.

Figure 27. Average incidence of Lyme disease cases by hospital district 1995–2004.

Type	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Plasmodium vivax	5	14	16	6	8	8	16	6	7	5
Plasmodium ovale	3	8	8	4	4	3	6	3	-	2
Plasmodium malariae	-	2	2	1	1	1	-	-	-	-
Plasmodium falciparum	24	21	31	27	16	25	16	21	15	20
Unidentified Plasmodium	-	2	2	3	-	1	-	1	-	-
Total	**32**	**47**	**59**	**41**	**29**	**38**	**38**	**31**	**22**	**27**

Table 18. Malaria cases by pathogen type 1995–2004.

Favourable humidity conditions for ticks, variations in animal reservoirs and the amount of time people spend out in the nature have an effect on the incidence of borreliosis.

Regionally the increase has been most intensive in Åland and the province of Southern Finland, but an increasing trend has been detected in all regions except the provinces of Oulu and Lapland with only a few sporadic cases. It is difficult to specify an exact geographical border for the occurrence of Lyme disease in the north. As regards the different diseases transmitted by ticks, the number of TBE virus infections causing tick-borne encephalitis has tripled during the ten-year-period, while the number of Lyme disease infections has nearly doubled (Figure 27).

MALARIA – HALF OF THE CASES ARE FINNS

In 2004, malaria was diagnosed in 26 persons in Finland, and in addition two vivax malaria relapses were detected. As earlier, the majority of cases, 20 (77%), were caused by *Plasmodium falciparum,* all of which had origins in tropical Africa (Table 18).

Fourteen cases had acquired the *P. falciparum* infection in West Africa, four in East Africa and two in Southern Africa. One case infected in Nigeria had a double infection: in addition to *P. falciparum,* this case was also infected by *P. ovale*. Altogether five *Plasmodium vivax* infections were detected, one from Ethiopia, Sudan, Mali, India and Brazil each. One case had been infected by *Plasmodium ovale* in Cameroon. In total, 92 percent of the new malaria cases had been acquired in tropical Africa (Figure 28).

Vivax malaria recurred in two patients even though they had received proper primaquine treatment in the year before in order to destroy any latent liver forms of vivax malaria acquired in Papua New Guinea. Primaquine resistance is known to occur in the region.

Half of the cases were Finns and half were foreigners, as in previous years. Twelve of the Finns had gone to a malaria-endemic region on a trip of less than six months. Two were Finns residing in a malaria-endemic region. Twelve cases were immigrants. Five of them came from a malaria-endemic region and they fell ill soon after arriving in Finland. Seven had lived in Finland for years and had gone to visit their former home country.

Most cases (21 patients, 81%) had taken no malaria prophylaxis or had taken it irregularly.

Vivax and ovale malaria can cause illness months or years after the infection due to latent parasites in the liver, regardless of proper prophylaxis. A few such cases occur every year, this year one *P. vivax* and one *P. ovale* infection. With three cases there was reason to suspect chloroquinine-

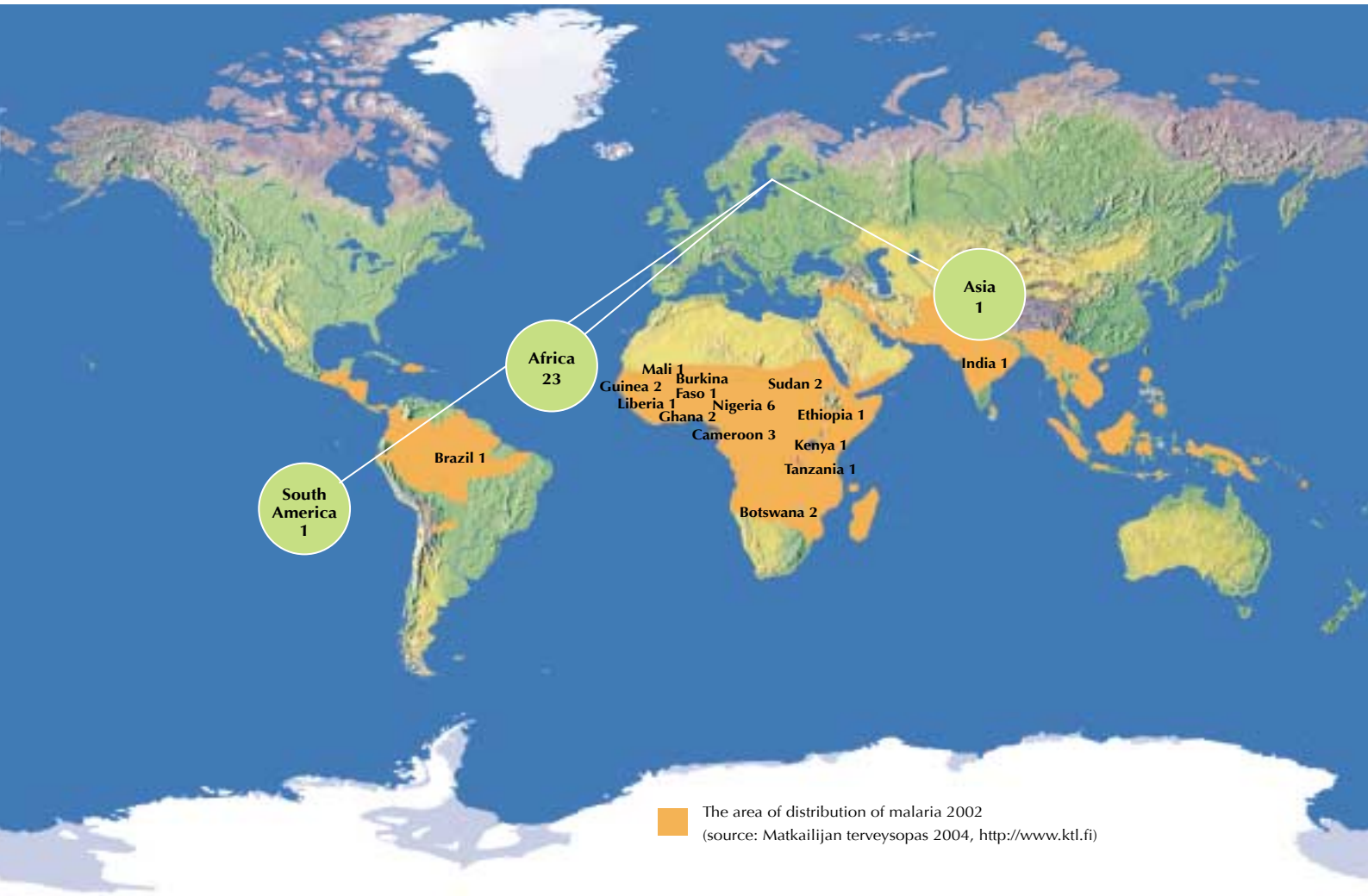


Figure 28. Malaria cases detected in Finland in 2004 by country of acquisition. The country of origin of two malaria cases diagnosed in Finland is not known.

resistant falciparum malaria: one had travelled to Tanzania and taken chloroquinine and proguanil medication, and two had gone to Zambia and taken chloroquinine only.

Majority of cases from Africa in 1995–2004

In the past ten-year period the number of malaria infections was highest in 1997 with 59 diagnosed cases, after which the number has varied between 30 and 40, but in the last couple of years there have been clearly fewer than thirty cases per year. Most of these are falciparum malaria cases, and the majority of all cases have been acquired in Africa.

Some of the cases are refugees, asylum seekers, adopted children or other immigrants recently arrived in Finland. A consistent risk group from year to year are immigrants from malaria-endemic regions who visit their former home country, often in West Africa, without taking malaria prophylaxis.

Most malaria cases, however, are Finns who have been on a short trip to a malaria-endemic re-

gion and have ignored prophylaxis totally or have taken it irregularly or used ineffective prophylaxis.

Chloroquinine alone or in combination with proguanil does not provide sufficient protection against malaria in Africa and in other regions with resistant malaria. In such regions the recommended prophylaxis is mefloquine, and should this be unsuitable, the alternative is a combination of atovaquone and proguanil (Malarone), or doxycycline. The decreased number of malaria patients in recent years is hopefully a sign of increasing use of efficient malaria prophylaxis.

ENTEROVIRUSES

The official taxonomy of enteroviruses changed between 1995 and 2004. The enterovirus genus is now divided into five species, comprising Human enteroviruses A–D (abbreviated HEV-A – HEV-D) and Poliovirus as the fifth species. The old subgroup names are still in use in serotype nomenclature. Enteroviruses cause, for example, infections of the central nervous system (aseptic meningitis, encephalitis, myelitis, neuritis, etc.), myocarditis and typical enterovirus diseases (hand, foot and mouth disease, epidemic myalgia, etc.). The notifications to the National Infectious Diseases Register do not include data on the clinical presentation.

Incidence peak in autumn

During the reporting period 1995–2004, altogether 1,373 laboratory-confirmed enterovirus infections were notified to the National Infectious Diseases Register; approximately 60 percent of the cases were male. In addition to the item "enterovirus", this figure also includes all the traditional subgroups, i.e., polio-, coxsackie- and echovirus infections. The annual variation in the number of findings is considerable (Figure 29). This is partly

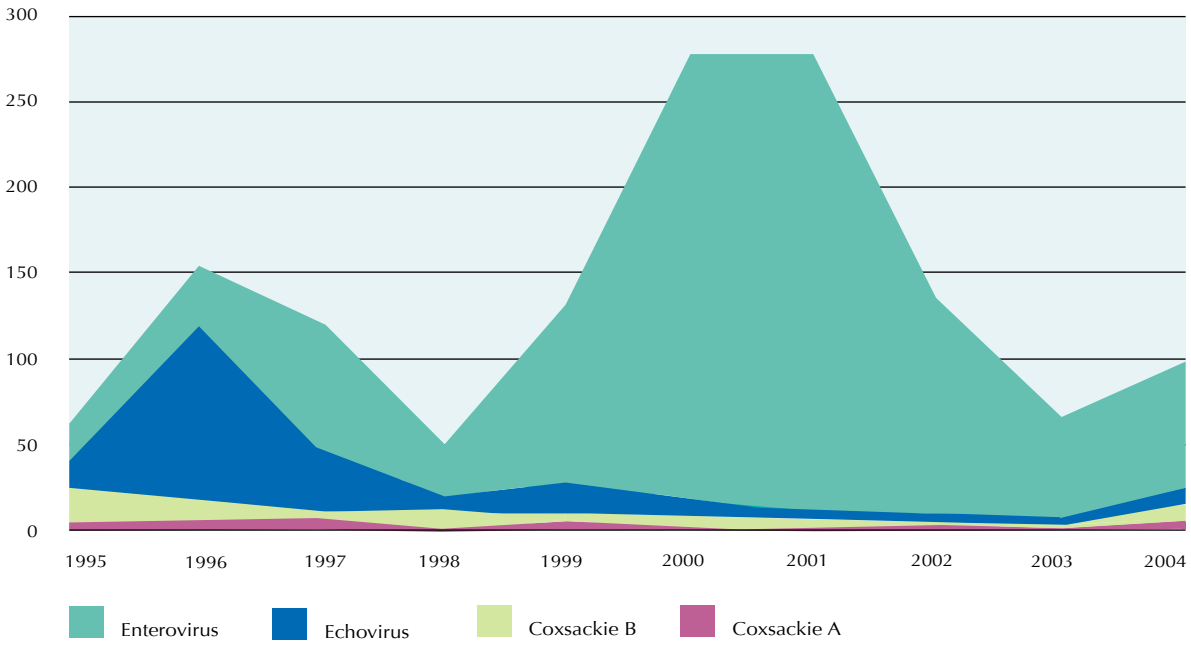


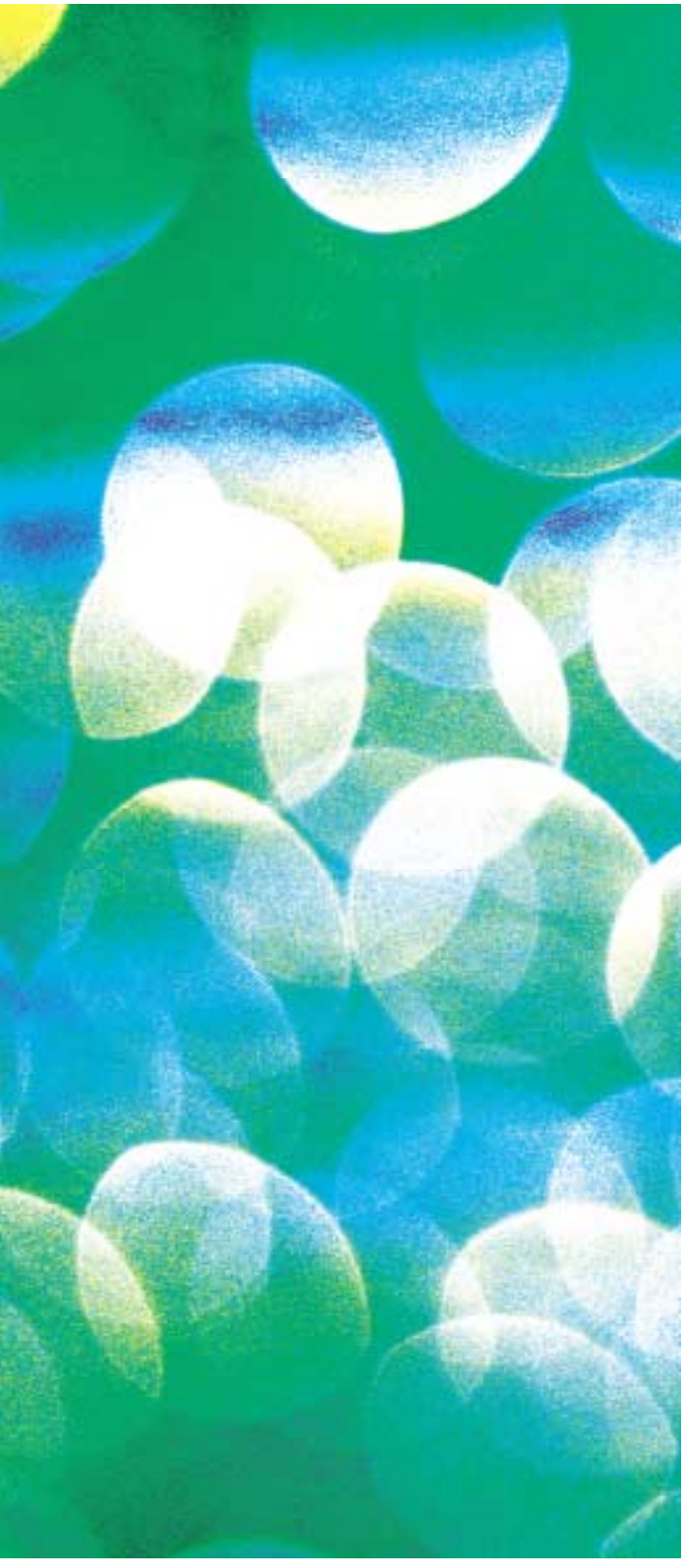
Figure 29. Cases of enterovirus infection 1995–2004.

explained by outbreaks, for example the echovirus 30 outbreak in 1996. On the other hand, one reason may also be the varying activity in sample taking, regulated by clinical-epidemiological research projects.

The most remarkable technical change during the period was the increased use of the RT-PCR method in addition to or instead of virus culture. Like conventional serology, ordinary enterovirus RT-PCR does not separate subgroups and serotypes. In some cases, for example in the diagnostics of aseptic meningitis, RT-PCR is clearly more sensitive than virus culture in detecting the virus in cerebrospinal fluid. Virus culture of stool is a useful method for monitoring the possible circulation of polioviruses in the population; this surveillance is still necessary in Finland.

Upper respiratory tract infection is an addition to the list of "typical" enterovirus diseases as a result of the introduction of the RT-PCR method. The implementation of RT-PCR has revealed their common occurrence. The ordinary enterovirus RT-PCR also amplifies rhinovirus sequences. Separation is not always performed, and the results of additional tests are not always unambiguous.

Even though enterovirus infections occur around the year, autumn is typically the peak season for enteroviruses in Finland. Individual studies have reported that enteroviruses are found also in winter, particularly in the airways, and this observation is reinforced by the data obtained during the surveillance. The monthly distribution of all findings follows the "enterovirus" findings in 1999–2002, when their proportion in the entire data was at highest. An autumnal peak can still be detected, but it is not as distinct as in the echovirus 30 epidemic in 1996–1997.



FINDINGS IN BLOOD AND CEREBROSPINAL FLUID

BLOOD CULTURE FINDINGS IN CHILDREN

Serious bacterial infections in children are consistently rare in Finland. The Hib vaccine has practically eradicated serious Hib infections *(Haemophilus influenzae* type b). In addition, this vaccination has reduced the total number of positive findings in cerebrospinal fluid and blood cultures. The concern of an increase in other serious *Haemofilus influenzae* infections along with the implementation of Hib vaccinations has not been realised. As there have been no outbreaks of meningococcal infection, the situation has been relatively calm.

During the 10-year surveillance period, more than 550 eases with positive blood culture findings per year have been detected in children under 15 years of age. In 2004, the number of positive blood-culture findings was record-breaking, 636. Only once before, in 2002, there were more than six hundred cases (626). The most common finding was *Staphylococcus epidermidis* or some other coagulase-negative staphylococcus. Treatment procedures related to intensive care, particularly cannulas and foreign bodies that remain in the body for a longer period of time, increase the susceptibility to these bacteria. In 2004, there were 187 such cases, 132 in the preceding year and 173 in 2002. In 1995–2000, a coagulase-negative staphylococcus in blood was notified 92–142 times. Coagulase-negative staphylococci were detected particularly in neonates and premature babies.

The other most common blood culture findings in 2004 included pneumococcus, *Streptococcus pneumoniae* (116), most of which (82) were detected in its typical age group 1–5 years, *Staphylococcus aureus* particularly in the age group 6–14 years. Findings of *Escherichia coli*, a common cause of

urosepsis, and group G betahaemolytic streptococcus, a bacterium transmitted to the child from the mother's birth canal, were notified almost solely in infants under 2 months old. In children aged six years or more, in addition to *S. aureus* findings, the most common notified causes of infection in 2004 were *E. coli* and pneumococcus. In the preceding years in this age group the number of pneumococcal findings was higher than the number of *E. coli* findings. The total number of pneumococcal cases did not increase during the surveillance period.

Meningococci were isolated from blood only seven times in 2004; five of these findings were in children under one year of age. The total number of *Pseudomonas aeruginosa* findings in the whole country was seven, and other gram-negative rods

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Microbe / microbial group										
Bacteria										
Staphylococcus, other than aureus, or unindentified	54	56	59	64	86	76	100	117	85	155
Streptococcus agalactiae	45	50	42	48	42	38	41	46	37	44
Escherichia coli	52	38	40	48	39	43	39	40	39	37
Staphylococcus aureus	27	22	22	33	29	17	17	24	21	32
Streptococcus pneumoniae	21	11	14	17	16	28	15	12	23	28
Streptococcus viridans group and unindentified	11	10	9	6	13	7	11	9	12	15
Enterococci	15	15	9	12	8	8	7	13	13	13
Klebsiella species	5	12	8	8	10	9	8	7	8	9
Enterobacter species	9	5	7	7	10	6	6	6	6	5
Neisseria meningitidis	3	6	2	5	4	8	3	2	2	5
Serratia species	1	-	-	1	-	3	-	5	2	4
Pseudomonas species	0	2	3	3	-	-	2	1	1	4
Streptococcus pyogenes	2	-	1	1	2	1	2	1	1	3
Streptococcus, other betahaemolytic	2	-	1	5	-	1	0	1	1	2
Bacillus	2	1	1	1	-	1	2	-	1	2
Acinetobacter species	4	1	1	3	2	1	0	4	3	1
Haemophilus species	-	3	-	3	-	2	3	-	3	1
Corynebacterium species	-	-	-	1	-	1	1	-	1	1
Clostridium species	2	-	2	1	1	-	1	1	-	1
Proteus species	1	1	-	-	2	1	-	-	-	1
Citrobacter species	3	-	1	2	2	4	2	1	1	-
Stenotrophomonas maltophilia	-	-	-	-	-	-	-	1	1	-
Propionibacterium species	-	-	-	3	1	1	-	1	-	-
Salmonella species	-	-	-	1	1	-	-	1	-	-
Bacteroides species	-	1	1	1	2	1	1	-	-	-
Listeria monocytogenes	1	2	1	-	-	1	-	-	-	-
Mycobacteria	-	-	-	-	-	-	-	-	-	-
Yersinia enterocolitica and pseudotuberculosis	1	-	-	-	-	-	-	-	-	-
Campylobacter species	-	-	-	-	-	-	-	-	-	-
Capnocytophaga canimorsus	-	-	-	-	-	-	-	-	-	-
Fusobacterium species	-	-	-	-	-	-	-	-	-	-
Other bacteria	2	4	1	3	8	7	3	8	7	6
Bacteria, total	263	240	225	277	282	265	264	301	268	369
Fungi										
Candida albicans	5	3	1	3	11	3	3	10	2	3
Other yeasts	1	1	-	-	5	9	8	8	2	-
Other fungi	-	-	-	-	-	-	-	-	-	-
Fungi, total	6	4	1	3	16	12	11	18	4	3
Total number of cases	**269**	**244**	**226**	**280**	**298**	**277**	**275**	**319**	**272**	**372**

Table 19. Blood culture findings 1995–2004, infants (under 1 year of age).

were detected as sporadic findings in different age groups. *Streptococcus pyogenes* was found in blood only six times in 2004, while in previous years the number of findings had been approximately double. No capsulated haemophili were detected in children in 2004 (Table 19–20).

Cerebrospinal fluid findings in children

More than 50 bacterial meningitis cases are detected every year in children under 15 years of age. In 2004, there were altogether 54 notified cases with bacterial findings from cerebrospinal fluid, the most common causes of infection being *S. pneumoniae,* group B streptococcus (GBS, *Streptococcus agalactiae)* and meningococcus, *Neisseria meningitidis*.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Microbe / microbial group										
Bacteria										
Streptococcus pneumoniae	71	87	74	60	61	72	76	87	89	88
Staphylococcus aureus	44	35	54	48	57	42	35	58	47	58
Staphylococcus, other than aureus, or unindentified	61	36	43	38	55	65	44	57	48	41
Streptococcus viridans group and unindentified	23	25	27	26	20	20	23	14	12	18
Escherichia coli	11	11	19	13	14	20	5	13	13	15
Enterococci	6	4	3	2	4	2	4	8	5	6
Klebsiella species	4	1	7	3	4	2	2	6	4	5
Streptococcus pyogenes	2	8	2	10	11	9	9	10	11	4
Pseudomonas species	4	6	7	8	2	7	10	5	7	3
Enterobacter species	4	5	3	3	2	2	-	1	6	3
Stenotrophomonas maltophilia	1	-	6	6	2	2	2	-	1	3
Neisseria meningitidis	3	11	8	9	12	9	9	8	6	2
Bacillus	3	5	4	1	4	9	2	5	6	2
Streptococcus, other beta-haemolytic	1	-	-	1	1	1	1	-	3	2
Salmonella species	3	2	1	2	7	1	1	2	2	2
Bacteroides species	1	1	-	2	-	4	1	1	-	2
Acinetobacter species	3	4	3	3	5	5	5	8	2	1
Streptococcus agalactiae	1	2	1	-	-	1	-	-	2	1
Fusobacterium species	1	6	4	2	5	4	1	3	-	1
Proteus species	-	-	-	-	1	-	-	-	-	1
Haemophilus species	2	3	3	2	2	2	2	1	5	-
Clostridium species	2	1	-	3	-	1	-	1	1	-
Corynebacterium species	2	-	1	-	3	3	1	1	1	-
Listeria monocytogenes	-	-	1	2	-	-	1	-	1	-
Propionibacterium species	-	-	3	-	2	-	-	-	1	-
Yersinia enterocolitica and pseudotuberculosis	1	-	-	-	-	-	-	-	1	-
Citrobacter species	-	-	2	-	2	1	1	1	-	-
Serratia species	1	1	1	-	-	-	-	1	-	-
Campylobacter species	-	-	-	-	1	2	1	-	-	-
Mycobacteria	-	-	-	-	-	-	-	-	-	-
Capnocytophaga canimorsus	-	-	-	-	-	-	-	-	-	-
Other bacteria	4	7	7	7	11	8	9	13	9	15
Bacteria, total	259	261	284	251	288	294	245	304	283	273
Fungi										
Candida albicans	6	1	2	-	2	4	1	2	1	-
Other yeasts	3	2	1	2	4	1	-	-	-	1
Other fungi	-	-	3	1	1	-	-	1	2	-
Fungi, total	9	3	6	3	7	5	1	3	3	1
Total number of cases	**268**	**264**	**290**	**254**	**295**	**299**	**246**	**307**	**286**	**274**

Table 20. Blood culture findings 1995–2004, children (1–14 years).

There were no notified findings of Hib, *Haemophilus influenzae* type b, in cerebrospinal fluid. Since the mid-1990s, the most common notified bacterial finding in children's cerebrospinal fluid has been meningococcus, with approximately 10 findings per year. Last year, however, there were only eight such cases, while there were ten notified cases of both pneumococcus and GBS. Also in 2003 pneumococcal findings in cerebrospinal fluid were twice as common as meningococcal findings. *S. aureus* in cerebrospinal fluid was notified in four children, and coagulase-negative staphylococcal findings in cerebrospinal fluid was notified in 13; seven of these were *S. epidermidis*. An enterobacterial species was detected in the cerebrospinal fluid of two children under 15, and Enterococcus was notified in three cases in the entire year.

The GBS findings notified from cerebrospinal fluid were all from cases under 1 year of age, as expected. All but one were less than two months old. The number of cases, 10, was the highest in the new millennium. Earlier GBS has been detected in

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Microbe / microbial group										
Bacteria										
Streptococcus agalactiae	2	8	2	9	4	4	2	5	1	10
Streptococcus pneumoniae	7	2	2	1	6	1	1	3	6	8
Staphylococcus, other than aureus, or unindentified	2	-	3	4	7	5	3	10	4	5
Neisseria meningitidis	2	3	3	2	2	5	4	1	2	4
Staphylococcus aureus	1	1	1	1	-	1	1	-	3	2
Escherichia coli	-	1	2	3	1	-	3	1	1	2
Enterococci	-	-	2	1	1	-	-	-	1	1
Propionibacterium species	-	-	-	-	-	-	-	-	1	1
Klebsiella species	-	-	-	-	-	-	-	1	-	1
Enterobacter species	-	-	-	-	-	-	-	-	-	1
Streptococcus viridans group and unindentified	2	-	-	1	-	1	-	-	1	-
Haemophilus species	1	1	-	1	-	1	2	-	-	-
Pseudomonas species	-	-	-	1	-	-	-	-	-	-
Streptococcus pyogenes	-	-	1	-	-	-	-	-	-	-
Streptococcus, other beta-haemolytic	-	-	-	-	-	-	-	-	-	-
Listeria monocytogenes	-	-	-	-	-	-	-	-	-	-
Mycobacteria	-	-	-	-	-	-	-	-	-	-
Bacillus	-	-	-	-	-	-	-	-	-	-
Corynebacterium species	-	-	-	-	-	-	-	-	-	-
Other bacteria	-	1	2	-	1	-	1	1	1	1
Bacteria, total	17	17	18	24	22	18	17	22	21	36
Fungi										
Candida albicans	-	-	-	-	-	-	-	-	-	-
Other yeasts	-	-	-	-	-	-	-	-	-	-
Other fungi	-	-	-	1	-	-	-	-	-	-
Fungi, total	-	-	-	1	-	-	-	-	-	-
Total number of cases	**17**	**17**	**18**	**25**	**22**	**18**	**17**	**22**	**21**	**36**

Table 21. Cerebrospinal fluid culture findings 1995–2004, infants (under 1 year of age).

cerebrospinal fluid in only 1–5 cases per year. The number of GBS findings in blood culture has remained relatively stable since the beginning of the 2000s, at 38–44 cases a year. *E.coli* meningitis is rare today: there were two findings in the cerebrospinal fluid of infants last year, as well as one Serratia and one Klebsiella (Table 21 22).

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Microbe / microbial group										
Bacteria										
Staphylococcus, other than aureus, or unindentified	-	8	3	4	7	7	2	10	3	6
Neisseria meningitidis	8	6	9	14	9	6	5	7	4	4
Streptococcus pneumoniae	5	6	2	6	6	2	2	1	7	2
Staphylococcus aureus	2	1	6	2	2	1	6	1	2	2
Enterococci	-	1	2	-	1	1	-	1	-	2
Streptococcus viridans group and unindentified	2	-	1	1	-	1	3	-	1	1
Enterobacter species	-	-	-	-	-	-	-	-	-	1
Haemophilus species	2	-	-	2	2	1	1	-	2	-
Mycobacteria	-	-	-	-	-	-	-	-	1	-
Klebsiella species	-	-	-	-	-	1	-	-	1	-
Streptococcus pyogenes	-	-	-	-	1	-	1	1	-	-
Streptococcus, other beta-haemolytic	-	-	-	-	-	-	-	1	-	-
Streptococcus agalactiae	-	-	-	-	1	-	1	-	-	-
Bacillus	-	-	-	-	-	1	-	-	-	-
Corynebacterium species	-	-	-	-	-	1	-	-	-	-
Escherichia coli	-	-	-	-	-	1	-	-	-	-
Listeria monocytogenes	-	1	-	1	-	-	-	-	-	-
Propionibacterium species	-	-	-	-	-	-	-	-	-	-
Pseudomonas species	-	-	-	-	-	-	-	-	-	-
Other bacteria	-	2	-	-	-	1	3	5	-	-
Bacteria, total	19	25	23	30	29	24	24	27	21	18
Fungi										
Candida albicans	-	-	-	-	-	-	-	-	-	1
Other yeasts	-	-	-	-	-	-	-	-	-	-
Other fungi	-	-	-	-	-	-	-	-	-	-
Fungi, total	-	-	-	-	-	-	-	-	-	1
Total number of cases	**19**	**25**	**23**	**30**	**29**	**24**	**24**	**27**	**21**	**19**

Table 22. Cerebrospinal fluid culture findings 1995–2004, children (1–14 years).

Blood findings in adults

The total number of cases with positive blood culture findings in adults increased by nearly 70 percent between 1995 and 2004, from fewer than 5,000 to nearly 8,000. The increase was greater among persons aged 65 or more than among working-age adults. There were no significant changes during the surveillance period in the proportions of gram-positive and gram-negative bacteria. Gram-positive bacteria are slightly more common in the working-age population and gram-negative bacteria among those aged 65 or more. The proportion of anaerobic bacteria of all blood culture findings was four percent and the proportion of fungi was two percent, and these proportions did not change.

In 2004, the most common pathogen among

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Microbe / microbial group										
Bacteria										
Escherichia coli	407	423	498	495	547	532	613	580	645	707
Staphylococcus aureus	279	288	349	340	389	394	437	457	444	484
Staphylococcus, other than aureus, or unindentified	265	311	293	342	359	413	421	461	421	435
Streptococcus pneumoniae	221	251	293	283	298	308	342	312	381	387
Streptococcus viridans group and unindentified	116	137	140	149	168	171	166	166	174	198
Klebsiella species	92	93	113	106	114	115	114	134	121	159
Enterococci	81	105	121	112	117	111	164	165	145	136
Streptococcus, other beta-haemolytic	40	45	58	59	64	59	66	78	79	102
Streptococcus pyogenes	34	35	55	63	81	84	60	93	78	93
Bacteroides species	64	55	71	68	77	71	70	66	59	73
Streptococcus agalactiae	45	43	53	55	60	63	76	78	68	64
Pseudomonas species	87	73	85	76	71	81	74	76	89	63
Enterobacter species	55	65	78	76	58	75	92	53	60	62
Salmonella species	35	20	14	28	40	21	38	13	25	40
Fusobacterium species	18	14	15	21	21	17	26	15	21	32
Citrobacter species	18	10	15	10	15	19	18	14	10	21
Proteus species	15	11	15	12	10	19	23	15	14	19
Clostridium species	28	20	39	32	28	30	24	18	23	18
Neisseria meningitidis	25	27	9	11	19	13	19	20	18	18
Haemophilus species	5	11	9	14	21	15	22	13	15	17
Acinetobacter species	21	23	16	8	17	18	9	13	10	16
Bacillus	6	15	12	12	8	23	20	18	22	15
Campylobacter species	9	11	8	10	5	11	14	7	10	13
Corynebacterium species	15	14	10	28	14	28	19	23	9	12
Stenotrophomonas maltophilia	14	17	10	7	5	11	15	14	6	12
Serratia species	4	7	11	10	12	8	10	12	14	10
Listeria monocytogenes	11	7	13	24	14	9	7	9	12	7
Propionibacterium species	3	13	15	20	18	20	19	8	11	6
Capnocytophaga canimorsus	4	4	7	3	8	3	6	6	6	6
Yersinia enterocolitica and pseudotuberculosis	1	5	3	4	6	1	3	2	1	1
Mycobacteria	15	10	1	5	-	3	4	2	4	-
Other bacteria	81	69	67	75	79	81	82	99	116	108
Bacteria total	2114	2232	2496	2558	2743	2827	3073	3040	3111	3334
Fungi										
Candida albicans	18	32	43	35	36	41	44	29	43	45
Other yeasts	11	13	9	16	18	15	27	23	36	24
Other fungi	3	4	2	11	4	-	-	2	1	2
Fungi, total	32	49	54	62	58	56	71	54	80	71
Total number of cases	**2146**	**2281**	**2550**	**2620**	**2801**	**2883**	**3144**	**3094**	**3191**	**3405**

Table 23. Blood culture findings 1995–2004, working-age population (15–64 years).

working-age adults (15–64 years) was *Esherichia coli,* which constituted a fifth of all cases based on blood culture findings. It was followed by *Staphylococcus aureus,* coagulase-negative staphylococci, *Streptococcus pneumoniae,* streptococci of the viridans group and Klebsiella species.

Among cases aged 65 years or more, *E. coli* was also by far the most common finding, representing nearly a third of all cases. Next in this age group came *S. aureus,* coagulase-negative staphylococci, Klebsiella species, *Streptococcus pneumoniae* and enterococci.

In 1995–2004, the number of *E. coli* and *S. aureus* cases increased equally among those of working age and those aged 65 years or more. The number of coagulase-negative staphylococci in-

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Microbe / microbial group										
Bacteria										
Escherichia coli	857	951	998	967	1012	1033	1178	1213	1314	1464
Staphylococcus aureus	277	322	322	296	337	396	398	449	466	483
Staphylococcus, other than aureus, or unindentified	253	265	256	231	294	372	388	379	370	399
Klebsiella species	143	155	161	177	167	201	241	230	252	341
Enterococci	145	145	140	168	169	210	224	215	241	303
Streptococcus pneumoniae	165	175	196	185	178	189	214	184	220	240
Streptococcus viridans group and unindentified	90	86	111	106	110	124	128	121	155	160
Pseudomonas species	138	124	112	103	127	128	135	154	154	141
Streptococcus, other beta-haemolytic	51	80	93	73	97	87	105	100	123	134
Bacteroides species	73	77	99	85	107	103	109	99	122	128
Enterobacter species	39	65	74	83	79	79	97	87	97	91
Proteus species	46	42	47	48	51	65	59	64	70	86
Streptococcus agalactiae	20	39	44	46	51	53	61	49	62	76
Clostridium species	51	46	44	36	40	47	57	47	45	57
Citrobacter species	11	26	18	19	24	26	39	40	44	43
Streptococcus pyogenes	20	17	22	31	22	22	28	46	28	31
Serratia species	12	14	13	18	11	15	30	15	28	18
Listeria monocytogenes	12	16	28	14	23	7	15	11	19	18
Haemophilus species	5	8	10	15	9	17	27	17	14	16
Acinetobacter species	7	10	8	10	7	13	18	17	8	13
Fusobacterium species	5	8	8	13	7	6	6	16	7	13
Corynebacterium species	6	11	9	16	7	21	16	15	7	11
Bacillus	8	2	1	6	7	13	17	11	10	10
Stenotrophomonas maltophilia	6	10	8	1	7	4	8	3	6	10
Propionibacterium species	5	11	20	12	24	19	12	15	4	8
Salmonella species	9	7	8	4	8	5	4	7	6	6
Campylobacter species	3	3	1	1	4	2	3	3	1	5
Neisseria meningitidis	2	3	1	2	3	5	4	4	4	3
Yersinia enterocolitica and pseudotuberculosis	2	3	1	5	2	3	3	2	4	3
Mycobacteria	-	1	-	3	-	2	2	1	2	3
Capnocytophaga canimorsus	-	1	3	-	-	3	1	1	1	1
Other bacteria	65	65	66	78	61	80	67	86	101	130
Bacteria total	2526	2788	2922	2852	3045	3350	3694	3701	3985	4445
Fungi										
Candida albicans	28	31	20	24	34	41	48	39	63	50
Other yeasts	17	4	14	15	17	27	22	32	47	27
Other fungi	1	1	2	4	-	-	1	-	3	-
Fungi, total	46	36	36	43	51	68	71	71	113	77
Total number of cases	**2572**	**2824**	**2958**	**2895**	**3096**	**3418**	**3765**	**3772**	**4098**	**4522**

Table 24. Blood culture findings 1995–2004, aged population (65 years and more).

creased slightly more among working-age adults, and the number of pneumococcal cases increased clearly more among those of working age than those aged 65 years or more. As regards the latter age group, in addition to the increase in *E. coli* findings, the number of other enterobacterial findings also increased (Klebsiella, Enterobacter and Citrobacter species). Enterococcus species, particularly *E. faecium,* increased both among the working-age population and the elderly.

The number of ß-haemolytic streptococcus findings per year more than doubled among adults in 1995–2004. *S. pyogens* or group A streptococcus increased clearly more strongly among working-age adults, *S. agalactiae* or group B streptococcus among those aged 65 years more, and group C streptococci increased both among the working-age population and the elderly.

Candida species increased clearly more strongly among the working-age adults than among the elderly. The proportion of species other than Candida albicans remained between 21 and 42 percent of all Candida findings in 1995–2004, without a distinct increase in their proportion. The number of *Pseudomonas aeruginosa* findings remained the same, as was also the case with the Acinetobacter species (Table 23–24).

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Microbe / microbial group										
Bacteria										
Staphylococcus, other than aureus, or unindentified	5	10	8	21	29	29	38	46	32	46
Streptococcus pneumoniae	16	19	21	23	18	16	24	11	21	21
Staphylococcus aureus	-	10	5	10	12	11	7	6	10	17
Neisseria meningitidis	34	37	21	18	18	13	12	19	15	12
Propionibacterium species	-	1	1	4	2	4	3	6	6	11
Enterococci	1	-	1	4	4	3	4	4	3	7
Enterobacter species	1	-	1	2	1	1	3	1	-	3
Pseudomonas species	-	-	2	3	5	5	4	5	5	2
Streptococcus agalactiae	1	4	-	-	1	-	-	1	-	2
Streptococcus viridans group and unindentified	1	3	2	6	3	4	3	6	2	1
Listeria monocytogenes	6	2	3	6	2	2	1	-	2	1
Klebsiella species	-	1	2	1	2	2	2	2	1	1
Corynebacterium species	-	-	-	2	1	1	2	-	1	1
Streptococcus, other beta-haemolytic	-	2	-	-	1	-	1	2	-	1
Haemophilus species	-	2	2	3	1	3	4	2	-	1
Mycobacteria	-	-	-	-	-	2	-	2	1	-
Streptococcus pyogenes	-	-	-	-	-	-	-	1	1	-
Bacillus	-	-	1	1	-	2	1	5	-	-
Escherichia coli	1	1	2	1	4	2	-	3	-	-
Other bacteria	2	3	1	3	3	6	4	5	4	3
Bacteria total	68	95	73	108	107	106	113	127	104	130
Fungi										
Candida albicans	-	-	-	1	2	2	-	1	1	2
Other yeasts	1	-	-	-	2	1	2	1	-	4
Other fungi	-	-	-	1	-	-	-	-	-	-
Fungi, total	1	-	-	2	4	3	2	2	1	6
Total number of cases	**69**	**95**	**73**	**110**	**111**	**109**	**115**	**129**	**105**	**136**

Table 25. Cerebrospinal fluid culture findings 1995–2004, working-age population (15–64 years).

Cerebrospinal fluid findings in adults

The number of adult cases with bacterial or fungal findings in the cerebrospinal fluid doubled from 1995 to 2004. The increase was slightly stronger among those aged 65 or more than among those of working-age. The increase among working-age adults was mainly due to the increase of coagulase-negative staphylococci and Propionibacterium species that belong to the normal flora of the skin. Candida species also increased. Among the elderly there was no single microbe or microbial group that explained the increase.

The most common cerebrospinal fluid finding in working-age adults was coagulase-negative staphylococci, followed by the virulent pathogens: meningococcus, pneumococcus and *S. aureus*. Meningococcal and pneumococcal findings were equal in numbers with the exception of the years 1995 and 1996 (meningococcal clusters). In 2004, *S. aureus* rose nearly to the same level for the first time.

Coagulase-negative staphylococci were the most common finding also among the elderly, followed by pneumococcus, *S. aureus* and *Listeria monocytogenes*. Pneumococcal and *S. aureus* findings per year were nearly equal in numbers, and the number of *L. monocytogenes* findings was slightly lower (Table 25–26).

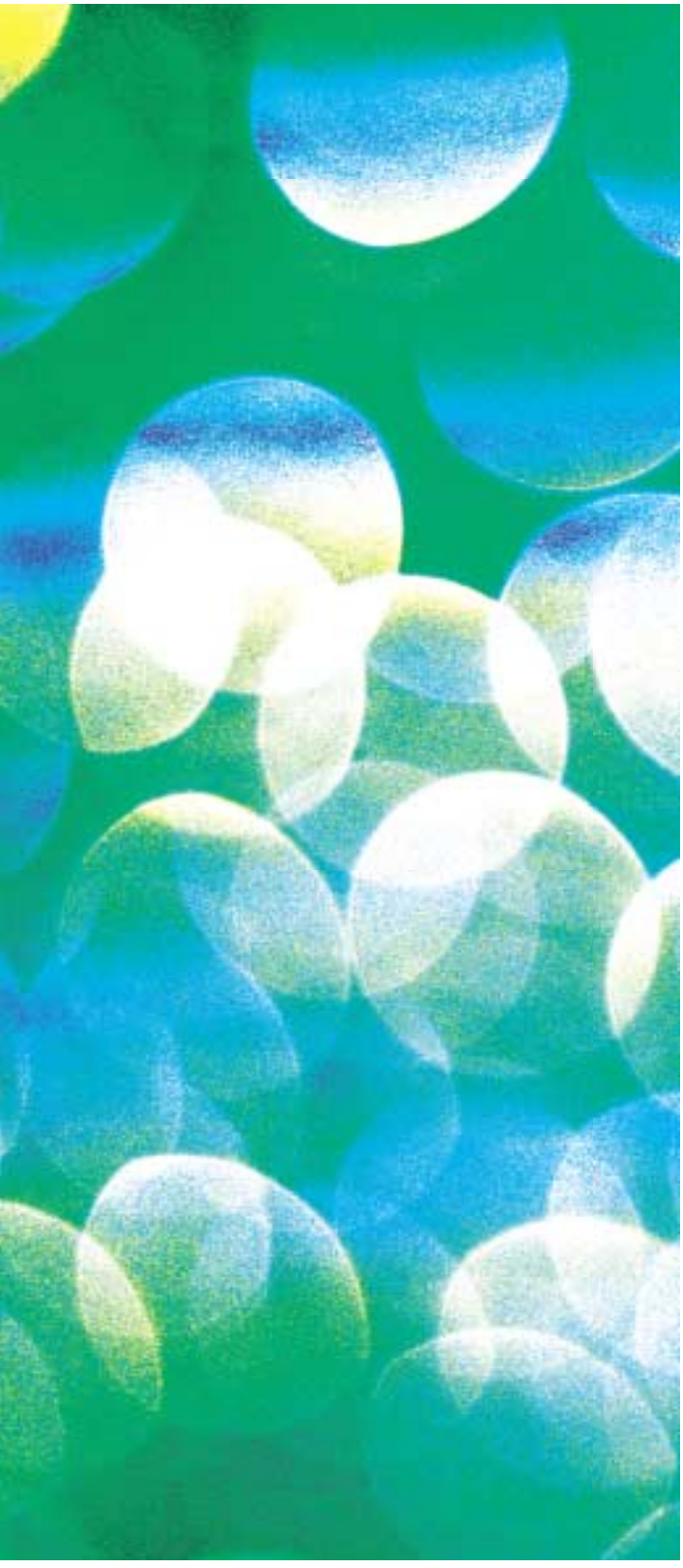
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Microbe / microbial group										
Bacteria										
Staphylococcus aureus	1	3	4	4	3	2	4	2	7	7
Staphylococcus, other than aureus, or unindentified	2	5	5	10	7	5	15	7	5	7
Streptococcus pneumoniae	6	6	4	5	4	6	4	4	5	4
Listeria monocytogenes	3	2	4	4	1	2	3	2	4	2
Escherichia coli	1	-	2	-	-	1	1	1	2	2
Neisseria meningitidis	1	2	-	2	1	-	1	-	1	2
Pseudomonas species	-	-	2	-	-	-	3	-	-	2
Mycobacteria	2	1	1	1	-	2	1	1	4	1
Klebsiella species	-	1	2	-	-	-	-	-	1	1
Propionibacterium species	-	-	-	1	-	-	2	4	-	1
Streptococcus viridans group and unindentified	-	2	1	-	1	1	1	2	-	1
Enterobacter species	-	-	1	-	-	-	1	2	-	1
Enterococci	-	1	3	1	-	1	1	3	4	-
Streptococcus, other beta-haemolytic	-	2	-	-	-	-	1	-	2	-
Streptococcus agalactiae	-	-	-	-	-	4	2	-	1	-
Corynebacterium species	-	-	-	1	-	-	-	-	1	-
Bacillus	-	-	-	1	1	1	3	3	-	-
Streptococcus pyogenes	-	-	-	-	-	-	-	2	-	-
Haemophilus species	-	-	3	-	2	-	-	-	-	-
Other bacteria	1	1	1	-	-	-	1	2	2	-
Bacteria total	17	26	33	30	20	25	44	35	39	31
Fungi										
Candida albicans	-	1	-	-	-	-	-	-	-	-
Other yeasts	-	1	-	-	-	-	-	2	-	1
Other fungi	-	-	-	-	-	-	-	-	-	-
Fungi, total	-	2	-	-	-	-	-	2	-	1
Total number of cases	**17**	**28**	**33**	**30**	**20**	**25**	**44**	**37**	**39**	**32**

Table 26. Cerebrospinal fluid culture findings 1995–2004, aged population (65 years and more).

INFECTIOUS DISEASES IN FINLAND 1995–2004

CONTRIBUTORS

Introduction	*Petri Ruutu*
Respiratory infections	
Influenza A and B	*Reijo Pyhälä*
Legionella	*Outi Lyytikäinen and Silja Mentula*
Whooping cough	*Tea Nieminen*
Mycoplasma	*Riitta Räty and Marjaana Kleemola*
Chlamydia pneumoniae	*Maija Leinonen and Mirja Puolakkainen*
RSV, parainfluenza, adeno	*Thedi Ziegler and Riitta Räty*
Intestinal infections	
Salmonella	*Markku Kuusi and Anja Siitonen*
Campylobacter	*Johanna Takkinen, Markku Kuusi, Anja Siitonen and Ulla-Maija Nakari*
Yersinia	*Johanna Takkinen and Anja Siitonen*
Shigella	*Markku Kuusi and Anja Siitonen*
EHEC	*Markku Kuusi, Anja Siitonen and Marjut Eklund*
Listeria	*Outi Lyytikäinen, Anja Siitonen and Ulla-Maija Nakari*
Food- and water-born outbreaks	*Markku Kuusi*
Rota- and Norovirus	*Markku Kuusi*
Hepatitides	
Hepatitis A	*Markku Kuusi*
Hepatitis B	*Tuija Leino*
Hepatitis C	*Pauli Leinikki*
Sexually transmitted diseases	
Chlamydia	*Eija Hiltunen-Back*
Gonorrhoea	*Eija Hiltunen-Back*
Syphilis	*Eija Hiltunen-Back*
HIV and AIDS	*Mika Salminen and Henrikki Brummer-Korvenkontio*
Mycobacterial infections	
Tuberculosis	*Petri Ruutu*
Molecular epidemiology of tuberculosis	*Hanna Soini*
Atypical mycobacteria	*Petri Ruutu*
BCG	*Ville Postila and Petri Ruutu*
Antimicrobial resistance	
MRSA	*Outi Lyytikäinen and Jaana Vuopio-Varkila*
Pneumococcus	*Outi Lyytikäinen, Pentti Huovinen and Merja Rantala*
VRE	*Outi Lyytikäinen and Jaana Vuopio-Varkila*
Other infections	
Hib	*Eija Kela*
Meningococcus	*Helena Käyhty*
MMR diseases	*Irja Davidkin*
Puumala virus	*Mari Kanerva and Outi Lyytikäinen*
Tick-borne encephalitis – TBE	*Pauli Leinikki*
Pogosta disease	*Pekka Nuorti*
Tularemia	*Pekka Nuorti*
Lyme disease	*Ilkka Seppälä and Jarmo Oksi*
Malaria	*Heli Siikamäki*
Enteroviruses	*Tapani Hovi and Merja Roivainen*
Findings in blood and cerebrospinal fluid	
Findings in children	*Tea Nieminen*
Findings in adults	*Peter Klemets and Outi Lyytikäinen*



APPENDIX TABLES

Appendix table 1. Cases notified to the Infectious Diseases Register by hospital district in 2004.

Notificatios by physicians and laboratories have been combined (*) for category 1 and 2 infections. Data for other microbes is based on laboratory notifications only.

	HUS	VAR	SAT	KHÄ	PIR	PHÄ	KYM	EKA	ESA	ISA	PKA	PSA	KSU	EPO	VAA	KPO	PPO	KAI	LPO	LAP	AHV	total
Respiratory infections																						
Adenovirus	106	42	29	10	26	18	12	12	14	6	5	16	13	35	12	8	21	14	3	16	3	**421**
Bordetella pertussis (whooping cough)	503	276	71	56	111	77	30	19	57	25	23	39	100	61	36	31	54	17	6	35	4	**1631**
Chlamydia pneumoniae	62	41	14	4	9	6	7	11	4	2	14	2	25	10	14	1	1	-	-	18	-	**245**
Influenza A virus	61	22	13	16	5	-	3	9	10	3	9	1	3	-	6	-	7	5	-	1	4	**178**
Influenza B virus	-	1	2	11	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	**16**
Influenza virus, untyped	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5**
Legionella*	6	1	2	1	-	-	-	-	1	-	-	1	-	-	1	-	1	-	-	1	-	**15**
Mycoplasma pneumoniae	399	181	94	16	50	16	25	48	30	7	51	60	108	12	40	23	99	8	3	24	3	**1297**
Parainfluenza virus	95	52	15	5	99	6	9	3	13	1	15	14	11	11	23	5	40	2	1	5	1	**426**
Pneumocystis carinii	9	-	-	-	-	-	1	2	-	-	-	1	-	2	-	-	-	-	-	-	-	**15**
RSV (respiratory syncytial virus)	449	125	92	58	96	59	50	34	43	26	32	39	39	55	32	11	102	35	31	68	2	**1478**
Intestial infections																						
Cryptosporidium	12	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**14**
EHEC (Enterohemorrhagic E.coli)*	2	-	-	-	-	-	-	-	-	-	2	3	1	-	-	1	1	-	-	-	-	**10**
Entamoeba histolytica	16	1	-	-	-	-	-	-	1	-	-	1	-	1	-	2	1	2	1	2	-	**28**
Giardia lamblia	135	23	1	5	19	7	4	4	6	2	4	14	4	4	7	5	18	4	2	11	3	**282**
Campylobacters	1508	257	133	106	278	103	108	77	47	27	95	164	149	118	73	26	176	37	35	60	6	**3583**
Norovirus	47	36	2	6	4	4	6	1	-	-	2	1	4	1	-	-	-	3	-	-	8	**125**
Rotavirus	247	19	68	35	176	64	40	44	11	18	53	31	73	75	44	33	194	34	10	53	-	**1322**
Salmonella Paratyphi*	5	1	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	**9**
Salmonella Typhi*	3	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	1	-	-	-	-	**6**
Salmonella, others	813	182	73	68	157	57	77	49	42	34	87	120	100	65	47	25	100	62	25	56	9	**2248**
Shigella*	57	8	3	3	12	1	5	2	3	-	3	4	-	-	3	-	4	-	-	1	-	**109**
Yersiniae	285	42	22	11	22	13	30	14	9	4	12	13	30	11	20	27	88	18	2	7	6	**686**
Hepatitides																						
Hepatitis A virus*	16	3	-	-	-	4	3	3	1	-	-	2	3	-	1	-	4	-	-	1	1	**42**
Hepatitis B virus, acute*	22	7	1	1	4	-	3	1	-	-	1	5	1	-	4	-	4	1	-	2	-	**57**
Hepatitis B virus, chronic*	98	31	-	7	17	5	21	10	4	-	8	5	6	1	24	7	25	16	1	10	5	**301**
Hepatitis C virus*	439	112	28	36	81	66	56	34	24	3	28	58	52	17	41	14	95	8	15	30	1	**1238**
Hepatitis D virus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	**1**
Hepatitis E virus	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	**2**
Sexually transmitted diseases																						
Chlamydia trachomatis	4056	1198	652	374	1286	419	311	272	242	112	393	566	747	426	349	156	896	185	195	429	93	**13357**
HIV*	83	8	2	1	4	4	2	4	2	-	5	1	-	2	4	1	4	-	-	-	2	**129**
Neisseria gonorrhoeae (gonorrhoea)*	122	17	2	2	20	13	1	4	1	3	8	10	5	9	5	2	7	2	6	8	5	**252**
Treponema pallidum (syphilis)*	57	1	-	-	1	2	4	6	5	1	4	4	7	2	4	-	5	1	-	1	1	**106**

Mycobacterial infections																							
Tuberculosis, pulmonary*	72	29	9	9	14	7	6	1	4	4	13	7	9	9	6	2	19	7	1	7	-	**235**
Tuberculosis, other organs*	25	15	6	5	8	1	6	-	4	2	5	10	7	4	5	-	7	1	-	1	-	**112**
Mycobacterium, atypical	118	29	33	14	24	9	11	9	16	6	8	25	17	44	16	16	41	8	11	12	1	**468**
Resistant bacteria																							
VRE (vancomycin-resistant enterococcus)	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	1	-	-	-	**19**
MRSA (methicillin-resistant Staphylococcus aureus)	633	39	77	8	252	36	22	36	29	10	34	63	47	11	3	5	111	8	10	26	-	**1460**
Streptococcus pneumoniae, Pen-I	106	16	21	3	30	5	6	8	4	3	4	15	7	4	7	1	44	7	1	4	-	**296**
Streptococcus pneumoniae, Pen-R	46	13	5	4	14	1	7	4	-	1	3	5	2	1	4	2	42	-	4	3	-	**161**
Other bacteria																							
Borrelias (Lyme disease)	322	83	21	12	2	9	47	16	20	13	22	35	19	-	14	8	5	3	2	5	477	**1135**
Corynebacterium diphtheriae (diphtheria)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Francisella tularensis (tularemia)	23	4	2	-	6	11	25	-	1	-	3	1	42	4	-	-	29	-	-	-	-	**151**
Haemophilus influenzae type b, blood/CSF findings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	**1**
Listeria monocytogenes*	5	3	2	2	2	2	2	2	-	1	1	2	2	2	1	2	1	3	-	-	-	**35**
Neisseria meningitidis*	10	6	4	1	4	3	1	1	1	1	-	1	1	2	3	-	1	3	1	3	-	**47**
Streptococcus agalactiae, blood/CSF findings	47	17	6	7	18	4	7	4	5	6	9	11	10	2	6	6	17	1	-	2	-	**185**
Streptococcus pneumoniae, blood/CSF findings	189	58	37	30	79	23	25	19	19	18	22	40	29	24	30	8	57	8	10	18	2	**743**
Streptococcus pyogenes, blood/CSF findings	53	9	3	3	5	3	4	3	2	1	6	8	6	2	3	-	12	3	4	-	1	**131**
Other viruses																							
Coxsackie A-virus	-	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5**
Coxsackie B virus	3	-	-	-	-	-	-	1	-	-	1	2	2	-	-	-	-	-	1	-	1	**11**
Echovirus	-	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**9**
Enterovirus	4	54	5	-	3	-	-	-	1	-	-	-	-	1	1	-	4	-	-	-	-	**73**
Parvovirus	30	8	1	-	-	3	-	6	-	1	-	1	1	2	1	1	-	-	-	-	-	**55**
Poliovirus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Puumala virus	124	28	35	26	81	25	4	37	121	80	47	183	181	60	53	30	162	77	20	55	-	**1429**
Mumps virus*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Sindbisvirus	10	2	1	2	5	4	2	-	-	1	4	3	1	1	2	1	1	-	-	-	-	**40**
Tick-born encephalitis virus (TBE)	6	1	1	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	19	**29**
Measles virus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Rubella virus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Other parasites																							
Echinococcus*	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2**
Plasmodium spp. (malaria)*	14	2	-	-	1	1	1	-	1	-	-	-	-	2	1	-	4	-	-	-	-	**27**

Abbreviation	Hospital district	Abbreviation	Hospital district	Abbreviation	Hospital district
HUS	Helsingin ja Uudenmaan shp	EKA	Etelä-Karjalan shp	VAA	Vaasan shp
VAR	Varsinais-Suomen shp	ESA	Etelä-Savon shp	KPO	Keski-Pohjanmaan shp
SAT	Satakunnan shp	ISA	Itä-Savon shp	PPO	Pohjois-Pohjanmaan shp
KHÄ	Kanta-Hämeen shp	PKA	Pohjois-Karjalan shp	KAI	Kainuun shp
PIR	Pirkanmaan shp	PSA	Pohjois-Savon shp	LPA	Länsi-Pohjan shp
PHÄ	Päijät-Hämeen shp	KSU	Keski-Suomen shp	LAP	Lapin shp
KYM	Kymenlaakson shp	EPO	Etelä-Pohjanmaan shp	AHV	Ahvenanmaa

Appendix table 2. Cases notified to the National Infectious Diseases Register 1995–2004.

Notificatios by physicians and laboratories have been combined (*) for category 1 and 2 infections. Data for other microbes is based on laboratory notifications only.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Respiratory infections										
Adenovirus	771	693	671	412	466	451	425	775	636	421
Bordetella pertussis (whooping cough)	505	586	606	832	918	839	315	581	1264	1631
Chlamydia pneumoniae	259	342	351	188	198	291	243	267	430	245
Influenza A virus	576	509	315	914	1426	1471	932	1381	2408	178
Influenza B virus	46	76	229	15	145	41	250	177	745	16
Influenza virus, untyped	-	-	-	-	-	-	369	94	396	5
Legionella*	6	12	11	8	9	7	17	18	20	15
Mycoplasma pneumoniae	597	467	224	251	224	740	1011	630	548	1297
Parainfluenza virus	206	182	237	223	164	263	413	352	214	426
Pneumocystis carinii	33	52	33	24	34	26	26	18	22	15
RSV (respiratory syncytial virus)	1 036	961	1953	586	1345	1888	1892	1690	1877	1478
Intestinal infections										
Cryptosporidium	14	11	16	9	5	4	12	18	7	14
EHEC (Enterohemorrhagic E.coli)*	-	-	-	44	36	17	18	17	15	10
Entamoeba histolytica	106	122	164	113	112	97	44	36	43	28
Giardia lamblia	261	261	333	296	282	221	302	264	284	282
Campylobacters	2 197	2629	2403	2851	3302	3526	3796	3597	3178	3583
Norovirus	-	-	-	150	167	367	229	836	379	125
Rotavirus	1 651	1507	1112	1373	1029	1437	1395	1550	2185	1322
Salmonella Paratyphi*	3	10	5	3	36	3	7	1	5	9
Salmonella Typhi*	8	3	3	3	8	-	1	3	6	6
Salmonella, others	3 455	2954	3070	2945	3033	2768	2906	2351	2279	2248
Shigella*	73	107	104	88	71	75	223	87	66	109
Vibrio cholerae (cholera)*	1	-	-	1	1	-	1	-	2	-
Yersinias	923	852	704	713	634	641	728	695	647	686
Hepatitides										
Hepatitis A virus*	164	186	169	120	48	51	51	393	242	42
Hepatitis B virus, acute*	112	290	316	246	256	239	127	176	106	57
Hepatitis B virus, chronic*	293	411	346	319	381	381	299	241	263	301
Hepatitis C virus*	1 358	1778	1904	1803	1753	1739	1491	1371	1265	1238
Hepatitis D virus	-	3	-	1	-	3	2	1	2	1
Hepatitis E virus	1	4	4	2	2	1	5	3	2	2

Sexually transmitted diseases										
Chlamydia trachomatis	8 032	8696	9651	10654	10658	11729	12140	13659	12862	13357
HIV*	72	69	71	81	143	145	128	131	132	129
Neisseria gonorrhoeae (gonorrhoea)*	378	226	218	269	255	284	247	235	189	252
Treponema pallidum (syphilis)*	169	219	172	187	140	204	159	128	133	106
Mycobacterial infections										
Tuberculosis, pulmonary*	438	432	363	396	385	370	317	297	292	235
Tuberculosis, other organs*	224	213	212	233	184	167	177	177	123	112
Mycobacterium, atypical	337	321	327	400	393	410	488	416	405	468
Resistant bacteria										
VRE (vancomycin-resistant enterococcus)	7	52	148	53	31	38	15	5	6	19
MRSA (meticillin-resistant Staphylococcus aureus)	89	108	120	189	211	261	340	599	851	1460
Streptococcus pneumoniae, Pen-I										296
Streptococcus pneumoniae, Pen-R										161
Other bacteria										
Borrelias (Lyme disease)	346	449	538	457	404	895	691	884	753	1135
Corynebacterium diphtheriae (diphtheria)*	3	3	-	-	1	-	2	-	-	-
Francisella tularensis (tularemia)	467	397	109	117	87	926	29	106	823	151
Haemophilus influenzae type b, blood/CSF findings*	6	5	2	4	7	2	4	4	8	1
Listeria monocytogenes*	34	29	53	46	46	18	28	20	41	35
Neisseria meningitidis*	78	79	46	54	58	48	51	49	42	47
Streptococcus agalactiae, blood/CSF findings	112	141	140	151	154	157	180	177	170	185
Streptococcus pneumoniae, blood/CSF findings	497	538	589	563	573	606	660	601	721	743
Streptococcus pyogenes, blood/CSF findings	58	60	81	105	116	116	100	153	118	131
Other viruses										
Coxsackie A virus	3	3	6	-	4	2	-	2	1	5
Coxsackie B virus	20	16	5	11	5	5	7	3	3	11
Echovirus	18	101	39	10	18	11	5	3	4	9
Enterovirus	19	33	71	30	103	260	266	128	57	73
Parvovirus	41	50	53	75	191	224	215	100	31	55
Poliovirus*	3	-	-	-	-	-	-	-	-	-
Puumala virus	888	907	758	1305	2300	774	1057	2603	1566	1429
Mumps virus*	6	2	2	1	1	-	2	4	1	1
Sindbisvirus	1 310	40	264	135	27	123	77	597	211	40
Tick-born encephalitis virus (TBE)	5	8	19	16	12	41	33	38	16	29
Measles virus*	6	-	-	1	-	2	1	-	-	-
Rubella virus*	6	2	1	1	-	-	-	3	-	-
Other parasites										
Echinococcus*	-	-	-	1	-	-	-	1	2	2
Plasmodium spp. (malaria)*	32	47	59	41	29	38	38	31	22	27

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