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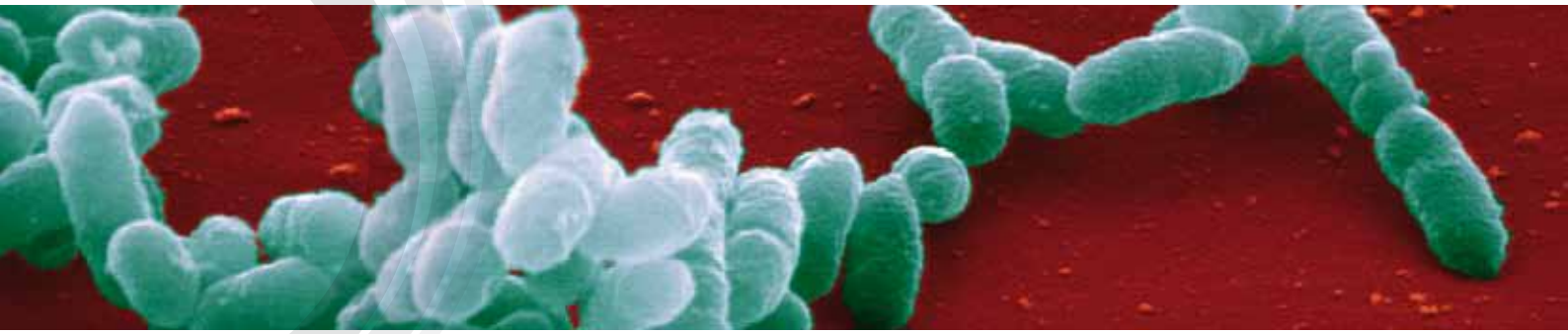

Surveillance of invasive bacterial diseases in Europe

Invasive pneumococcal disease, invasive *Haemophilus influenzae* disease and invasive meningococcal disease

2011

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ECDC SURVEILLANCE REPORT

Surveillance of invasive bacterial diseases in Europe, 2011

Invasive pneumococcal disease, invasive *Haemophilus influenzae* disease, invasive meningococcal disease

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Abbreviations

CC	Clonal complex
CFR	Case–fatality rate
CSF	Cerebrospinal fluid
CTX	Cefotaxime
CFX	Ceftriaxone
EEA	European Economic Area
ERY	Erythromycin
EU	European Union
EUCAST	European Committee on Antimicrobial Susceptibility Testing
EU-IBIS Network	European Invasive Bacterial Infections Surveillance
IBD	Invasive bacterial disease
IMD	Invasive meningococcal disease
IPD	Invasive pneumococcal disease
Hib	*Haemophilus influenzae* type b
MCC	Meningococcal C conjugate vaccine
MIC	Minimum inhibitory concentration
PCV7	Hepta-valent pneumococcal conjugate vaccine
PCV10	10-valent pneumococcal conjugate vaccine
PCV13	13-valent pneumococcal conjugate vaccine
PEN	Penicillin
PPV23	Pneumococcal polysaccharide vaccine
SIR	Susceptible, Intermediate, Resistant classification (antimicrobial susceptibility to Penicillin, Erythromycin and Cefotaxime/Ceftriaxone)
TESSy	The European Surveillance System
WHO	World Health Organization

Executive summary

This report describes the occurrence of invasive bacterial diseases (IBD) in Europe during 2011.

The main aim is to provide information on the epidemiological trends, circulating strains and morbidity caused by invasive bacterial diseases resulting from *Streptococcus pneumoniae, Haemophilus influenzae* and *Neisseria meningitidis* in Europe. This is the first time that all three diseases have been included in an ECDC surveillance report.

Invasive bacterial diseases remain an important public health issue across Europe and continue to cause serious, preventable disease in several countries, particularly among the young and the elderly.

For invasive pneumococcal disease (IPD), the majority of infections were caused by serotypes covered by PCV13, although non-vaccine serotype 6C is becoming more prominent. The emergence of non-vaccine serotypes remains an important issue and continued monitoring of serotype replacement in Europe is essential.

For invasive *H. influenzae* disease, the highest notification rate was observed in non-capsulated strains among cases aged less than one year while there was a decrease in serotype b infections. At a European level, more robust surveillance data is needed for serotype replacement to be accurately assessed.

For invasive meningococcal disease (IMD), serogroup B was the predominant cause of cases in 2011. It was most prominent in young children and the rates were 10 times greater than cases of serogroup C infection in the same age group. The development of a serogroup B vaccine provides the potential to further reduce the incidence of this disease. Pre- and post-marketing surveillance of this vaccine is essential. Additionally, MCC vaccine post-marketing surveillance must be maintained. There was an increase in serogroup Y infections and the quality of surveillance and availability of molecular typing methods for this serogroup must be improved.

Twenty-six EU/EEA Member States submitted data on IPD to the European Surveillance System (TESSy). Twenty-seven EU/EEA Member States provided data on invasive *H. influenzae* disease and 29 on IMD. The majority of participating countries have a mandatory passive surveillance system in place for all three diseases. Data from sentinel surveillance systems was analysed for Cyprus and the Netherlands for all three diseases. Sentinel surveillance was also reported by Belgium and France for IPD and by Belgium, France and Spain for invasive *H. influenzae* disease. Case-based data was submitted by all countries, except for Bulgaria (for all three diseases) and Latvia (for IPD). Case definitions differed from country to country, with the majority applying the 2008 EU case definitions. Population statistics were obtained from Eurostat, the statistical office of the European Union.

Surveillance systems undergo various changes over time that may have an impact on the data reported by individual countries or overall – changes in case definitions, population coverage, data collection and validation and introduction of new laboratory methods.

Data heterogeneity across Member States may also be attributable to differences between disease surveillance systems, such as sensitivity or laboratory capacities and practices. These limitations must be considered when interpreting the data presented in this report.

Invasive pneumococcal disease (IPD)

Overall, 20 843 confirmed cases of IPD were reported by 26 EU/EEA countries in 2011, giving a notification rate of 5.59 cases per 100 000 population. The Nordic countries reported the highest country-specific rates. There was a clear seasonal distribution of cases with a noticeable rise during the winter months.

In 2011, there were 1 872 cases aged under five years. As in previous years, infants (aged <1 year) (11.7 per 100 000) and the elderly (aged ≥65 years) (14.2 per 100 000) were most affected. A steady decreasing trend in the notification rate was observed for cases aged less than one year and a stable trend observed in 1-4 year olds. Slovenia reported the highest proportion of cases aged 1-4 years (18.4%). PCV is not part of the routine immunisation schedule in Slovenia.

Notification rates among males were higher than among females in all age groups. The most common clinical presentation was septicaemia, although data on clinical presentation was missing for 47.3% of cases.

Serotypes 7F, 19A, 3 and 1 were the most common cause of IPD. Serotype 19A was the most common serotype reported in children aged under one year, followed by 7F. In children aged one to four years, serotypes 19A and 1 were the most frequently reported, while serotype 1 contributed 37.0% of all serotypes isolated from cases in the 5–14 year-old age group. Serotype 3 was more common in older age groups but was also prominent among younger patients. All four serotypes are covered by the pneumococcal conjugate vaccine PCV13 (1 and 7F are also covered by PCV10).

Serotype 6C was the only change to the top 10 most common serotypes from 2010. While it is not covered by any currently licensed vaccine, there is evidence that PCV13 has the potential to confer cross-protection against this

serotype. Serotypes 22F, 8 and 12F (covered by PPV23) and serotypes 14 and 4 (covered by PCV7, 10 and 13) were also among the top 10 serotypes in 2011.

More than 50% of cases occurring in all age groups were caused by a PCV13 serotype while <15% of cases were caused by a PCV7 serotype. Serotypes in the majority of the reported cases aged 15 years and above would have been covered by PPV23. Compared to 2010, PCV10 and PCV13 serotype caused a lower proportion of cases in all age groups in 2011.

Serotype 11A presented the highest serotype-specific case–fatality rate (25.3%), while the third highest serotype-specific CFR was in serotype 23A (16.4%), which is not covered by any licensed vaccine.

Pneumococcal conjugate vaccines are currently available in 29 EU/EEA countries and are part of routine vaccination in 23 countries (VENICE II[1] [2]). The incidence of IPD in children aged <5 years in countries without routine vaccination varies, with some countries reporting higher incidence rates than the European average, and some reporting lower incidence rates.

The emergence of non-vaccine serotypes remains an important issue. Currently, in Europe the majority of IPD infections are caused by PCV13 serotypes. However, as observed with PCV7, the overall effectiveness of PCV13 may decrease overtime as new pneumococcal serotypes emerge. Continued monitoring of serotype replacement in Europe is essential to assess changing trends and interventions and inform the development of new vaccines. Overtime, improvements in laboratory capacities will provide more and more accurate data on this issue.

Invasive *Haemophilus influenzae* disease

Overall, 2 152 confirmed cases of invasive *H. influenzae* disease were reported by 24 EU/EEA countries in 2011. The notification rate across Europe was 0.58 cases per 100 000 population. Due to the success of Hib vaccination programmes over the last 20 years it has become a rare disease in the majority of Member States. Countries in the north-west of Europe reported the highest rates. There was a clear seasonal distribution of cases with a noticeable rise during the winter months.

As in previous years, infants (3.4 cases per 100 000) and the elderly (1.6 per 100 000) were most affected, with males more affected than females in these age groups. Notification rates across all age groups have remained relatively stable since 2008. The most common clinical presentation was septicaemia, although data on clinical presentation was missing for 54.4% of cases.

Overall, non-capsulated strains made up 77% of cases. Notification rates of non-capsulated strains were highest among cases aged less than one year (1.62 per 100 000), for which the trend fluctuated over time. Moreover, there was a slight increase in cases aged 15–64 years. Overall, there is an upward trend in disease caused by non-capsulated strains.

Serotype b made up 7% of cases. *H. influenzae* type b has been a major cause of morbidity and mortality prior to the introduction of conjugate vaccines. However, since the introduction of routine childhood *H. influenzae* type b (Hib) vaccination programmes, invasive *H. influenzae* type b disease has substantially decreased in Europe and continues to decrease, particularly in cases aged under five years. Between 2008 and 2011 the total number of type b infection cases aged <5 years more than halved, and only three EU/EEA countries reported notification rates of serotype b infection >1 per 100 000 in cases aged under five years. In total, 564 cases of serotype b infection were observed in this period.

Non-b serotypes caused 16% of cases. Among serotype non-b infections cases in infants under one year are decreasing and cases in the age group 65 years and above are increasing. Serotype f made up 69.6% of non-b serotypes.

There have been some concerns about serotype replacement as a consequence of the conjugated *H. influenzae* type b vaccine. Increased incidence of non-b and non-capsulated strain infection has been observed in recent years, however this may be partly explained by the extension of enhanced surveillance systems to include all serotypes and/or clinical presentations, and an increased awareness among clinicians due to these changes. At a European level, more robust surveillance data is needed for serotype replacement to be accurately assessed, particularly with regard to serotype data, which was missing for 50.7% of cases in 2011.

[1] http://venice.cineca.org/VENICE_Survey_PNC_1_2012-02-24.pdf

[2] http://vaccine-schedule.ecdc.europa.eu/Pages/Scheduler.aspx

Invasive meningococcal disease (IMD)

Overall, 3 808 confirmed cases of IMD were reported by 29 EU/EEA countries in 2011, a notification rate of 0.77 cases per 100 000 population, with the majority of Member States reporting <1 cases per 100 000. There was a clear seasonal distribution of cases with a noticeable peak in January.

As in previous years, infants were most affected (12.3 cases per 100 000). Notification rates were lower in older age groups, although a small peak was observed in adolescents and young adults (15–24 year olds). There was a notable decrease among cases under one year of age (20.7 per 100 000 in 2008, 12.3 in 2011). There was also a small decrease in cases aged 1-4 years (4.5 in 2008, 4.1 in 2011).

In Europe, 73.6% of IMD was caused by serogroup B in 2011 and was most prominent in infants (10.0 per 100 000) and 1-4 year olds (3.3 per 100 000). Among infants, 88.3% of cases (n=535) were due to serogroup B, although the trend is decreasing in this age group, as a result of reduced numbers of cases in the UK. Serogroup B showed an overall decreasing trend. Following successful clinical trials, the European Commission recently granted a licence for a vaccine against group B disease and this will soon be available for possible inclusion in childhood immunisation programmes.

Serogroup C accounted for 14.4% of cases in 2011 and 8.1% of cases (n=49) in infants aged <1 year. Notification rates were highest in infants aged <1 year (0.92 per 100 000) and in 1-4 year olds (0.36 per 100 000). These rates are significantly lower (10 times) than for cases of serogroup B infection in the same age groups. There is a slight overall decrease in the number of serogroup C infections, although trends appear to be inconsistent across all age groups.

Notification rates of serogroup C disease were higher in countries without Meningococcal C conjugate (MCC) vaccination. This difference was greatest in the 1-4 year-old age range (0.2 per 100 000 in cases from countries with MCC, 0.9 in countries without MCC). From 2008 to 2011 a downward trend was observed in cases of serogroup C infection aged <5 years in countries with MCC. A stable trend was observed in countries without MCC vaccination.

There was an increasing trend in serogroup Y, although the incidence rate remains very low. The quality of surveillance and the availability of molecular typing methods for this serogroup must be improved.

Meningitis was the clinical presentation in 42.6% of cases, although data on clinical presentation was missing for 49.1% of cases. There was no relationship observed between a specific clinical presentation and serogroup. The CFR in EU/EEA countries was highest in the elderly and in cases with septicaemia. The CFR among cases with serogroup C IMD was twice as high as for serogroup B, although this observation should be interpreted with caution as in Europe there is no common approach to the follow-up time or end-point for a fatal outcome. Molecular typing showed that the bacterial population was highly diverse, in line with findings in previous years.

IMD appears to be rare in Europe, and the development of a serogroup B vaccine provides the potential to further reduce the incidence of this disease. Pre- and post-marketing surveillance of this vaccine is essential. Additionally, MCC vaccine post-marketing surveillance must be maintained. Since introduction, the MCC vaccine has proved effective in reducing the burden of serogroup C infection and encouraging the development of herd immunity. Evidence suggests that MCC vaccination in adolescents and young adults should be considered to maintain herd immunity within the population. Currently, fifteen countries in Europe have MCC vaccination in their routine national immunisation programmes, eight of which offer vaccination after 11 years of age[3].

About ECDC

The European Centre for Disease Prevention and Control (ECDC), an EU agency based in Stockholm, Sweden, was established in 2005. The objective of ECDC is to strengthen Europe's defences against infectious diseases. According to Article 3 of the founding Regulation (EC) No 851/2004[4] of 21 April 2004, ECDC's mission is to identify, assess and communicate current and emerging threats to human health posed by infectious diseases. In order to achieve this mission, ECDC works in partnership with national public health bodies across Europe to strengthen and develop EU-wide disease surveillance and early warning systems. By working with experts throughout Europe, ECDC pools Europe's knowledge in health to develop authoritative scientific opinions on the risks posed by current and emerging infectious diseases.

[3] http://vaccine-schedule.ecdc.europa.eu/Pages/Scheduler.aspx

[4] Regulation (EC) No 851/2004 of the European Parliament and of the Council of 21 April 2004 establishing a European Centre for disease prevention and control. *OJ L 142, 30.4.2004, pp. 1–11.*

Surveillance at ECDC

The surveillance of IPD, invasive *H. influenzae* disease and IMD is important to estimate their incidence and to monitor disease trends and changes in serogroup/serotype and genotype distribution in order to guide policymakers in the definition of national immunisation schedules. The pooling of European data increases the accuracy of estimates for diseases where the number of reported cases is steadily decreasing.

From 1999 to 2007, the European Union Invasive Bacterial Infections Surveillance Network (EU-IBIS) ran a dedicated surveillance network in Europe for the surveillance of invasive bacterial diseases caused by *Neisseria meningitides* and *Haemophilus influenzae*. The network was successfully coordinated by the Health Protection Agency (now Public Health England) in London and the project was funded by DG SANCO. The surveillance of IPD was not covered by the EU-IBIS network. In October 2007, coordination of the EU-IBIS surveillance activities was transferred to ECDC. After the transition, the establishment of the EU enhanced surveillance for IPD was identified as one of the top priorities, by both Member State representatives and ECDC. As a result, various projects such as Pnc-EURO, were funded to ensure implementation.

Today, the surveillance of IBD consists of a range of networks operated through ECDC. Data on IBD is submitted by national contact points in Member States to ECDC through The European Surveillance System (TESSy), where the data is validated before analysis. In addition, vaccination schedules in European countries were regularly updated and published by EUVAC.NET. Vaccination schedules can now be found in the recently launched ECDC vaccine schedule[5]. Data on antimicrobial resistance is collected and analysed by the European Antimicrobial Resistance Surveillance Network (EARS-Net, former EARSS). Both EARS-Net and activities included in the former EUVAC.NET are operated by ECDC. For *S. pneumoniae*, data on antimicrobial resistance is collected by both TESSy and EARS-Net. Further details on this can be found in 3.4.10 Antimicrobial resistance.

IBD case definitions used in Europe

For the 2011 data collection, participants were requested to report cases of IBD applying the 2008 EU case definition. Full sets of published case definitions have been made available[6]. Member States were encouraged to apply the 2008 EU definition when collecting data on confirmed IBD cases in 2011, however, several case definitions were used by the reporting countries:

For IPD:

- 18 countries applied the 2008 version of the EU case definition
- one country applied the 2002 version of the EU case definition
- two countries applied other case definitions
- five countries did not refer to any case definition.

For invasive *H. influenzae* disease:

- 19 countries applied the 2008 version of the EU case definition
- three countries applied the 2002 version of the EU case definition
- two countries applied other case definitions
- three countries did not refer to any case definition.

For IMD:

- 20 countries applied the 2008 version of the EU case definition
- one country applied the 2002 version of the EU case definition
- five countries applied other case definitions
- three countries did not refer to any case definition.

Laboratory diagnosis of IBD requires the bacterium to be isolated and cultured from a normally sterile body site, or for bacterial nucleic acid or antigen to be detected at a normally sterile body site. Some sterile body sites include: cerebrospinal fluid (CSF), blood, joint fluid, synovial, pleural effusion, pericardial effusion, peritoneal fluid, subcutaneous tissue fluid, placenta, amniotic fluid or petechial skin.

A key difference between the 2002 and 2008 versions of the EU case definition is that the latter no longer contains clinical criteria and only defines confirmed cases. In addition, a confirmed case no longer needs to meet any clinical criteria. Historical data until 2007 do not distinguish between case definitions and categories and thus also include probable cases and cases defined by definitions other than the EU case definition.

[5] http://vaccine-schedule.ecdc.europa.eu/Pages/Scheduler.aspx

[6] See Commission Decision of 28 April 2008 amending Decision 2002/253/EC laying down case definitions for reporting communicable diseases to the Community network under Decision No 2119/98/EC of the European Parliament and of the Council: Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:159:0046:0090:EN:PDF

IBD data sources, submission and validation

This report includes confirmed cases of IPD, invasive *H. influenzae* disease and IMD reported by the national public health institutes and ministries of health in the EU/EEA countries for 2011. The initial data call made by ECDC to Member States for 2011 data used Metadataset 25. Analysis in this report is based on national data uploaded directly by the reporting countries to TESSy up to 20 March 2013. The system allows the reporting of aggregate data, although case-based reporting is favoured by ECDC.

The population-based analyses used the population on 1 January of 2012 as the denominator. These data have been obtained from the Eurostat database (http://epp.eurostat.ec.europa.eu).

Along with the data collection, countries were asked to provide a description of their national surveillance systems which acts as a guide to interpreting national data. Tables containing this information are included in the report for all three bacteria (see Annex 1 Table A1, Annex 2 Table B1, Annex 3 Table C1).

The competent bodies[7] for surveillance in the Member States have designated national contact points for IBD surveillance who work together with ECDC on the reporting of IBD data to TESSy. The national contact points were requested to submit data to TESSy using the latest metadataset agreed by the Member States. The IBD dataset consists of a core group of variables, including epidemiological and laboratory variables, common to all diseases combined with an enhanced dataset specific for each disease.

Twenty-six EU/EEA countries reported data on all three IBD in 2011. Portugal did not submit data for IPD. Germany, Liechtenstein and Luxembourg did not submit data for IPD or invasive *H. influenzae* disease. Liechtenstein did not submit data for any of the three diseases.

The cleaning and validation process included automatic and manual checks aiming to identify any inconsistency in the data. Validation rules were based on the EU 2008 case definition. The draft report was shared with all Member States for comments and confirmation of national figures.

[7] The ECDC founding regulation states that in its relations with the Member States ECDC shall cooperate with the competent bodies operating in its technical field, particularly in the area of surveillance [Regulation (EC) No 851/2004 of the European Parliament and of the Council, Art. 3, Par. 2.] Available at: http://ecdc.europa.eu/en/aboutus/Key%20Documents/0404_KD_Regulation_establishing_ECDC.pdf]

1 Invasive pneumococcal disease (IPD)

1.1 Introduction

Invasive pneumococcal disease (IPD) is an acute and life-threatening disease caused by *Streptococcus pneumonia*, a common commensal of the upper respiratory tract that can cause local and invasive infection. Invasive disease encompasses severe syndromes including meningitis, septicaemia, pneumonia/empyema and bacteraemia and may result in serious sequelae and permanent impairment. Children are at major risk together with immuno-compromised patients and the elderly. WHO estimates that 1.6 million people, including one million children under 5 years, die of IPD annually [1]. Of the 93 different serotypes characterised, only 20-30 are responsible for the majority of IPD worldwide [2].

Despite its frequency and severity, pneumococcal disease can be prevented by vaccination. A 23-valent pneumococcal polysaccharide vaccine for adults based on the main serotypes causing IPD was licensed in 1983. The first pneumococcal conjugate vaccine (PCV7) for infants and young children was licensed in Europe in 2001. A variety of studies have shown the conjugate vaccine to be safe and effective. The introduction of the vaccine markedly decreased the incidence of IPD caused by vaccine serotypes [3, 4]. Moreover, the vaccination of infants has resulted in 'herd immunity' by reducing nasopharyngeal carriage and transmission of the bacterium, contributing to a decrease in pneumococcal morbidity and mortality among the older age groups [5, 6]. Serotype replacement overtime has gradually reduced the efficacy of PCV7 as the rates of carriage and disease of non-vaccine serotypes increase [7]. New conjugate vaccines, PCV10 and PCV13, covering an increased range of serotypes, have been marketed in Europe to combat this, however continued serotype replacement remains an important challenge in the development of future vaccines [8].

In general, community-acquired respiratory infections, and those caused by *S. pneumonia* in particular, are the main clinical entities for prescription of antimicrobial agents in young children. Antimicrobial use and abuse is one of the main reasons for the emergence of antimicrobial resistance in respiratory pathogens. Individuals that carry and hence potentially transmit resistant pneumococci are also at higher risk of developing invasive pneumococcal disease caused by resistant strains [9].

1.2 Main points

- Overall, 20 843 confirmed cases of IPD were reported by 26 EU/EEA countries in 2011.
- The notification rate across Europe was 5.59 cases per 100 000 population, with Nordic countries reporting the highest country-specific rates. Rates ranged from 16.62 (Denmark) to 0.28 (Lithuania).
- There was a clear seasonal distribution of cases with a noticeable rise during the winter months.
- As in previous years, infants (11.7 per 100 000) and the elderly (14.2 per 100 000) were most affected. The notification rate among cases aged 1-4 years was 6.6 per 100 000. There is a steady decreasing trend in the notification rate for cases aged less than one year. Notification rates were higher in males than females in all age groups.
- Of all cases reported in 2011, 45.9% were among adults aged 65 years and above.
- Slovenia reported the highest proportion of cases aged 1-4 years (18.4%). PCV is not part of the routine immunisation schedule in Slovenia.
- The 10 most common serotypes were, in ranking order: 7F, 19A, 3, 1, 22F, 8, 14, 12F, 6C and 4. Serotypes 19A, 7F, 1 were the most common serotypes in cases aged <15 years. Serotypes 7F, 19A, 3, 1, 14 and 4 are covered by PCV7, 10 or 13, with serotypes 22F, 8 and 12F covered by PPV23. Serotype 6C is not covered by any vaccine currently licensed.
- Serotypes 22F and 8 showed the highest proportional increase in infections from 2010–2011. These serotypes were more prominent in cases aged 15 years or older. Serotypes 14 and 1 showed the largest proportional decrease.
- Serotype 11A presented the highest serotype-specific case–fatality rate (25.3%). The third highest serotype-specific CFR was in serotype 23A (16.4%), which is not covered by any licensed vaccine (PCV7, 10, 13 and PPV23). There was an increase in the proportion of serotype 23A infection between 2010 and 2011.
- The emergence of non-vaccine serotypes remains an important issue and continued monitoring in Europe is essential for assessing interventions and informing the development of new vaccines.
- In theory, by vaccinating with PCV13 it could potentially have been possible to prevent more than 50% of cases occurring in all age groups. Vaccinating with PCV7 can prevent <15% of cases. Serotypes in the majority of the reported cases aged 15 years or older would have been covered by PPV23.
- Compared to 2010, a lower proportion of cases in all age groups were caused by a PCV10 or PCV13 serotype in 2011.
- Septicaemia was the reported clinical presentation in 77% of cases, although data on clinical presentation was missing for 47.3% of cases.
- The overall CFR in EU/EEA countries was 10.3% and this was highest in cases with meningitis (15.2%) and in adults aged 65 years and over (14.3%).

- Antimicrobial non-susceptibility was highest for erythromycin and there was high level resistance (≥32mg/L) in 19.3% of isolates. Multi-drug resistance was observed in serotypes 14, 19, 19A, 19F, 23F and 6B, similar to 2010.
- There was a high proportion of missing data for the following variables: vaccination status, outcome, clinical presentation and antimicrobial resistance. Results that incorporate these variables must be interpreted with caution. Differences in surveillance systems should be considered in the analysis of all variables.

1.3 Methods – data analysis and quality

1.3.1 Data source

Most of the countries that reported confirmed cases in 2011 have comprehensive surveillance systems in place. Belgium, Cyprus, France and the Netherlands reported sentinel surveillance data. According to the data source profiles uploaded by countries, 18 countries had a reconciled notification/laboratory surveillance system (meaning that laboratory data and epidemiological and/or vaccination information are collected and filed together on a case-by-case basis at national level). Only five countries had laboratory-based surveillance systems and only three presented data from a notification system. In this report, France is the only country where data is reported from two sources.

The Czech Republic also has two data sources; however no confirmed cases were reported by the data source CZ-EPIDAT in 2011 so this data source was not considered in this report. The Netherlands also has two data sources but data from NL-OSIRIS was excluded from the report after consultation with national representatives.

With regard to population coverage, at national level France applies a correction factor of 1.61904 to estimate the total number of cases in its national reports (the correction factor has not been applied for this analysis). Greece has a surveillance system with national coverage for meningitis only. There is no single surveillance system in the UK.

1.3.2 Data analysis

Due to the potential overlap of data sources, surveillance system population coverage or age restrictions, the following criteria were applied for specific countries in the analysis of IPD data:

- For France, data on IPD are reported by two sentinel surveillance sources. The data reported by the data source 'Community invasive infections hospitalised' (FR-EPIBAC notification data) were taken into account for the general variables (e.g. age, gender, notification rates). The population coverage rate from this data source was declared (Annex 1 Table A2) and was applied for the notification rates analysis. Data uploaded from FR-PNEUMO-NRL (combined notification-laboratory data) data source were taken into account for the analysis of the laboratory variables (e.g. laboratory methodology and serotype). As both data sources were included in the report, data from both sources are taken into account in Annex 1 Table A1.
- Belgium reported sentinel surveillance data, for which the population coverage was unknown and so data from Belgium were excluded from the notification rates analysis.
- Cyprus reported sentinel surveillance data, for which the population coverage was unknown and so data from Cyprus were excluded from the notification rates analysis.
- For the Netherlands, only data reported from the sentinel surveillance source NL-NRBM were included in the report, while data from NL-OSIRIS were excluded, meaning that the data are less complete. The population coverage of NL-NRBM for IPD is 25%. In previously published IPD reports data from NL-OSIRIS were used.
- Bulgaria and Latvia reported aggregated data which were included where possible.

This report includes the total number of reported confirmed cases of IPD and a description of epidemiological and laboratory variables with appropriate completeness. Statistical analysis was performed using STATA® 12.0 (StataCorp, USA) and data are presented with the 'date used for statistics' as the preferred date. This is the date that the country chooses as its preferred date for reporting and could be date of disease onset, date of diagnosis, date of notification, or any other date the country uses nationally.

Notification rates were calculated using the number of cases as the numerator and total population, or surveillance system population coverage, as the denominator. Countries that reported sentinel surveillance include Belgium, Cyprus, France and the Netherlands. Both France and the Netherlands reported the level of population coverage in their sentinel systems and so were included in the notification rates analysis. Notification rates for these countries should be interpreted with caution. The level of population coverage in Belgium and Cyprus was unknown and these countries were therefore not included in the notification rates analysis. In figures or tables where notification rates over time are considered, only those countries that reported for all the years displayed were included. In such cases countries are listed below the respective figure/table.

There is no common definition of the point in time at which a fatal outcome is determined. This may add variation to the outcome figures throughout Europe. Acknowledging the differences in IPD surveillance systems and reporting across Europe, CFR was calculated on a country basis. A serotype-specific case–fatality rate was calculated following the same rule. Consequently, only cases with known outcomes were considered. Unless presented, all other 'unknown' and 'missing' responses were excluded from analysis.

The vaccination status 'fully vaccinated' and 'partly vaccinated' were defined by the reporting country according to its immunisation schedule. For clinical presentation cases could not be recorded as 'bacteraemia' or 'bacteraemia/pneumonia'. Instead 'septicaemia' or 'setpicaemia/pneumonia' were available. Therefore cases of bacteraemia or bacteraemia/pneumonia may be reported as septicaemia or septicaemia/pneumonia.

Member States were asked to provide minimum inhibitory concentration (MIC) and interpretation of antimicrobial susceptibility testing expressed as susceptible (S), intermediate (I) and resistant (R), according to the standards and protocols used for antimicrobial susceptibility testing at national level. However, some countries submitted data on MIC but not on SIR and conversely, other countries only reported SIR but not MIC. Therefore, data were analysed and presented separately as SIR and MIC. Completeness was comparable between SIR and MIC data, with SIR data slightly more complete. Since information was lacking on national standards and methods for antimicrobial susceptibility testing, MIC data are presented in a standard format to be interpreted according to the standards used at national level. As a reference, EUCAST clinical breakpoints[8] were used to determine resistance. Non-susceptibility is defined as resistant + intermediate isolates. Multi-drug resistance is defined as isolates resistant to penicillin, erythromycin and cefotaxime/ceftriaxone.

1.3.3 Data quality

In 2011, 20 843 confirmed cases of invasive pneumococcal disease (IPD) were reported by 26 countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom. Germany, Liechtenstein, Luxembourg and Portugal did not report data on IPD in 2011.

Data on serotypes were reported by 23 countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom. Data on antimicrobial susceptibility were submitted by 22 countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Hungary, Iceland, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, and United Kingdom.

All cases considered for inclusion in the analysis were laboratory-confirmed cases. All countries reported case-based data except Bulgaria and Latvia, who submitted aggregated data.

Overall, data on age, age month, gender, classification and specimen were complete, or almost complete. There was significant improvement in data completeness for serotype (26.1% missing, down from 53.3% in 2010), however, data completeness of the test method used for serotyping remained low (51.0% missing), indicating that the serotyping method is not known for some cases of serotype reported (Annex 1 Table A3).

Data on vaccination status represented less than 15% of the total reported cases. Minimum inhibitory concentration (MIC) data were reported in approximately 20–30% of the total reported cases. Antimicrobial resistance data expressed as susceptible (S), intermediate (I) and resistant (R) was marginally more complete among some antimicrobials, such as penicillin (33.5%) and erythromycin (33.4%) (Annex 1 Table A3).

1.3.4 Laboratory methods used for strain identification

Blood isolates accounted for 90.1% (n=14 607) of the total number of cases for which the specimen was reported (n=16 208) (Annex 1 Table A4). Children under one year showed the highest proportion of CSF isolates by age group, (26.8%) followed by the 5–14 year age group (16.0%). Cases aged over 15 years represented 86.4% of the data (Annex 1 Table A5).

Serotyping methods

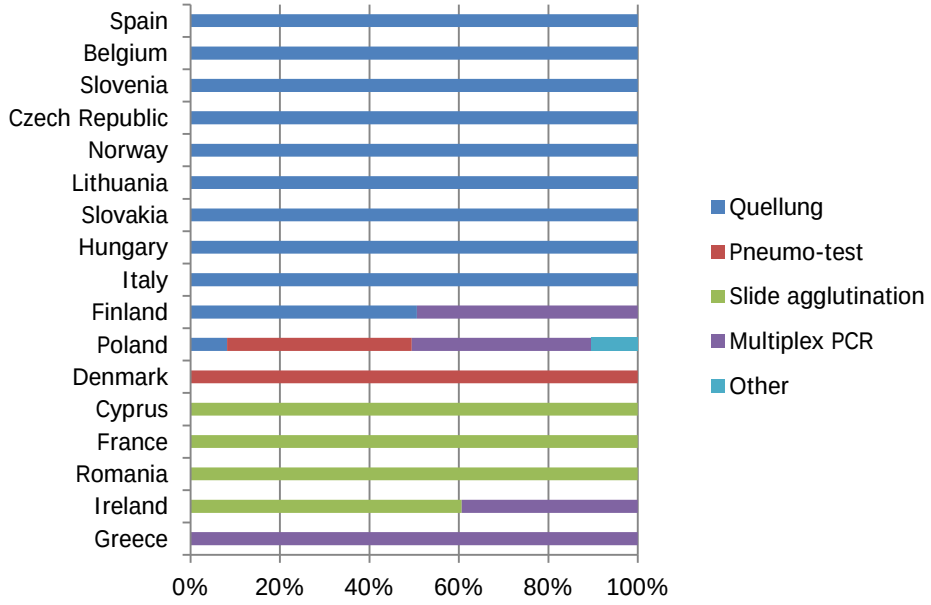
In Europe, a variety of laboratory methods are used to serotype strains, such as Quellung, slide agglutination, latex agglutination, co-agglutination, multiplex PCR, and gel diffusion.

According to the data, Quellung is the preferred technique for serotyping in Europe and was used in 65.1% of all cases for which a serotype was reported. This was followed by slide agglutination and Pneumotest®, a commercial kit that uses either latex agglutination or Quellung.

Of the 16 378 cases for which information on serotype was available, the test method was reported in 9 343 (57.0%) cases. Some cases were reported to the serogroup level (i.e. serogroup 19, serogroup 7). This may indicate that some countries may have reported to the serogroup, but not the serotype level. Finland, Ireland and Poland used two or more methods for serotyping pneumococcal strains (Figure 1.1).

[8] http://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Breakpoint_tables/Breakpoint_table_v_3.1.xls

Figure 1.1 Proportion of reported serotyping test methods used among cases reported as IPD by country, in EU/EEA countries, 2011 (n=9 343*)



**Only data from FR-PNEUMO-NRL for France*

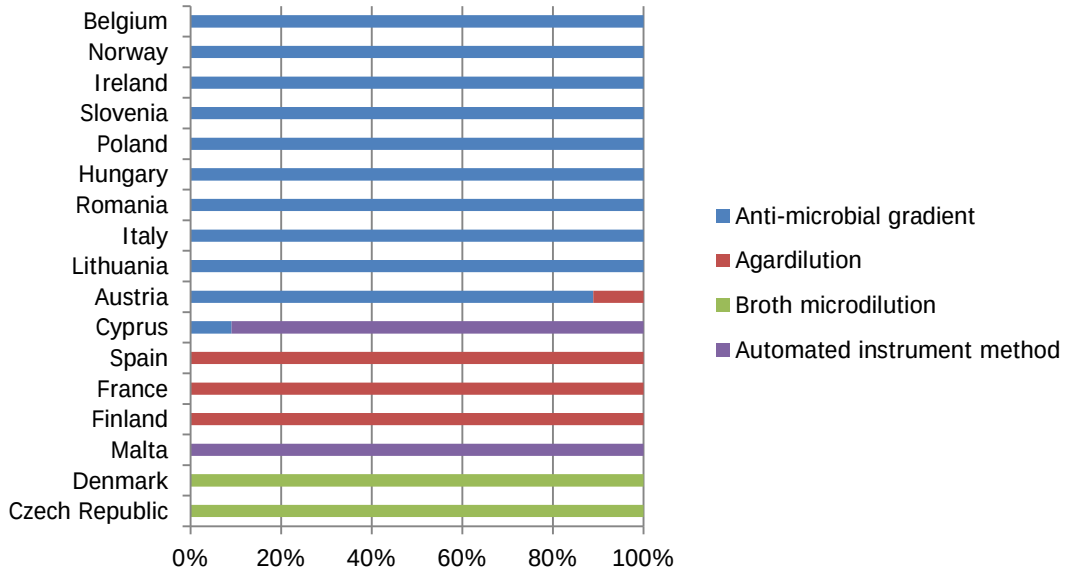
Antimicrobial susceptibility testing methods

In Europe a variety of laboratory methods are used to test antimicrobial susceptibility, including antimicrobial gradient diffusion and broth dilution.

Member States reported antimicrobial susceptibility testing results expressed as minimum inhibitory concentration (MIC) and/or categorised S, R, I (susceptible S, intermediate I or resistant R) according to national standards and protocols. A separate analysis is provided in order to facilitate comprehension. Completeness was comparable between SIR and MIC data, with SIR data slightly more complete (Annex 1 Table A3). Not all countries reported data for all antimicrobials.

Of the 8 416 cases for which information on MIC test methods was available, the test method was reported in 8 378 (99.5%) cases. Agar dilution and antimicrobial gradient are the preferred methods for determining MIC, representing 95.1% of all cases for which MIC was reported. Antimicrobial gradient is the preferred method in 10 of the countries reporting MIC data. All but two countries applied a single method for determining MIC (Figure 1.2).

Figure 1.2 Proportion of reported MIC test methods used among cases reported as IPD by country, EU/EEA countries, 2011 (n=8 378*)



**Only data from FR-PNEUMO-NRL for France*

1.4 Results

1.4.1 Number of cases

In 2011, 20 843 confirmed cases of IPD were reported to TESSy by 26 EU/EEA countries. The overall reported confirmed case rate was 5.59 per 100 000, ranging from 16.62 (Denmark) to 0.28 (Lithuania). Nordic countries (Denmark, Finland, Norway and Sweden) presented the highest notification rates, although in these countries rates were lower than in 2010. A high notification rate was also observed in the Netherlands (15.59), where sentinel surveillance data was reported and population coverage is only 25%. From 2008–2011, an increasing trend was observed in the Czech Republic, Latvia and Poland, with decreasing trends in Finland, Lithuania, Sweden and Norway. Notification rates in all countries need to be interpreted and compared cautiously due to the diversity of surveillance systems and variations in the completeness/representativeness of their data (Table SP1).

Table 1.1 Number of reported cases and notification rates (cases per 100 000 population) of IPD cases in EU/EEA countries, 2008–2011

Country	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
Austria	133	1.58	296	3.52	325	3.87	158	1.88
Belgium^	1875	-	2051	-	1851	-	1836	-
Bulgaria*	35	0.47	46	0.61	26	0.35	37	0.49
Cyprus^	21	-	9	-	11	-	12	-
Czech Republic	117	1.11	143	1.36	300	2.85	384	3.65
Denmark	120	2.16	129	2.32	960	17.26	924	16.62
Estonia	32	2.39	14	1.04	14	1.04	18	1.34
Finland	925	17.21	855	15.91	836	15.55	779	14.49
France#	-	-	-	-	5117	10.79	5037	10.62
Greece	63	0.56	66	0.58	38	0.34	41	0.36
Hungary	65	0.65	49	0.49	108	1.08	107	1.07
Ireland	401	8.95	357	7.97	304	6.78	357	7.97
Italy	694	1.14	738	1.22	854	1.41	713	1.18
Latvia	7	0.31	7	0.31	16	0.72	51	2.29
Lithuania	18	0.55	16	0.49	9	0.28	9	0.28
Malta	0	0.00	9	2.16	11	2.63	11	2.63
Netherlands#	609	14.63	605	14.53	571	13.71	641	15.39
Poland	212	0.55	274	0.72	333	0.87	351	0.92
Romania	0	0.00	122	0.57	80	0.37	90	0.42
Slovakia	36	0.66	29	0.53	18	0.33	57	1.05
Slovenia	204	9.95	253	12.34	224	10.93	255	12.44
Spain	1 648	3.57	1339	2.90	2212	4.79	2220	4.81
Sweden	1 789	19.00	1618	17.18	1456	15.46	1361	14.45
United Kingdom~	5 514	8.82	5019	8.03	5616	8.99	4632	7.41
EU Total	**14518**	**3.95**	**14044**	**3.82**	**21290**	**5.79**	**20081**	**5.46**
Iceland	-	-	-	-	32	10.05	33	10.36
Norway	855	17.38	799	16.24	748	15.20	729	14.82
Total	**15373**	**4.12**	**14843**	**3.98**	**22070**	**5.92**	**20843**	**5.59**

** Aggregated reporting*
^ Sentinel surveillance, population coverage unknown so notification rate not included
 # Sentinel surveillance, population coverage known.
~ There is no single surveillance system in the UK. Data are representative (as submitted by England and Wales, Scotland and Northern Ireland), however surveillance systems might not be identical.

1.4.2 Seasonality

The seasonal distribution of cases of IPD follows a pattern similar to that of other respiratory diseases. In 2011 the highest rates were observed during the winter months, with rates decreasing in the summer, as was observed in previous years. This sequence was observed for the total number of cases, the ten most frequently isolated serotypes and by age group (Figures SP3, SP4 and SP5). Seasonality by country is presented in Annex 1 Table A6.

Figure 1.3 Distribution of reported IPD cases by month of year, in EU/EEA countries, 2011 (n=20 839)

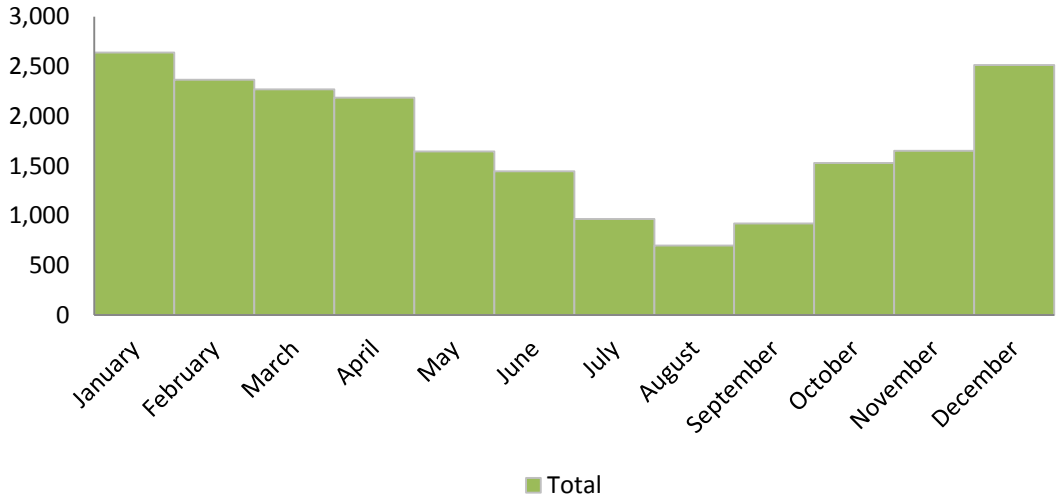


Figure 1.4 Distribution of reported IPD cases by month and top ten most frequently isolated serotypes in EU/EEA countries, 2011 (n=9 248)

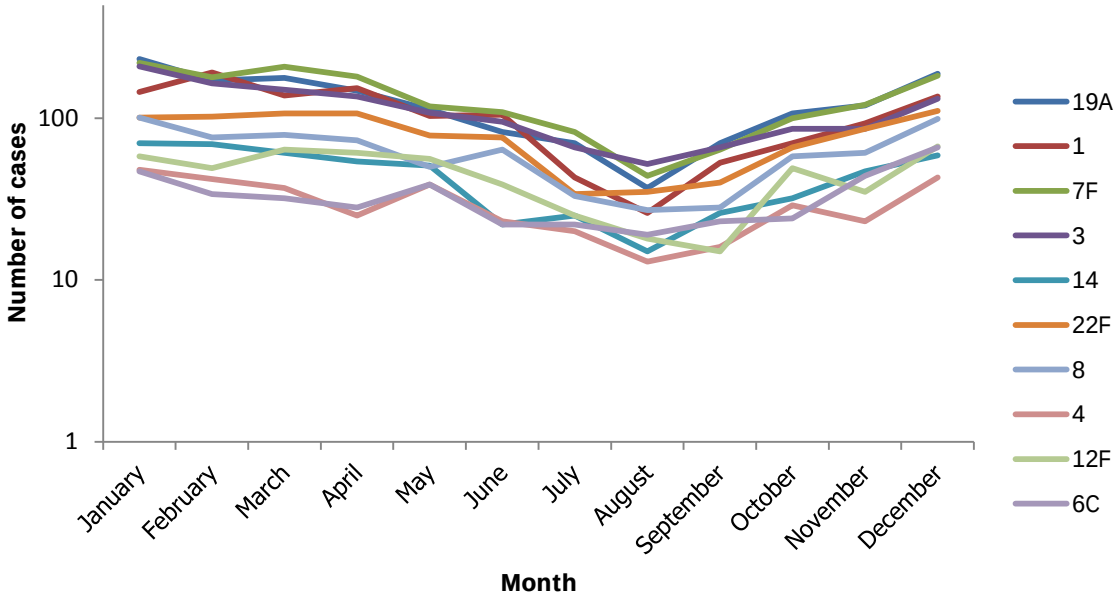
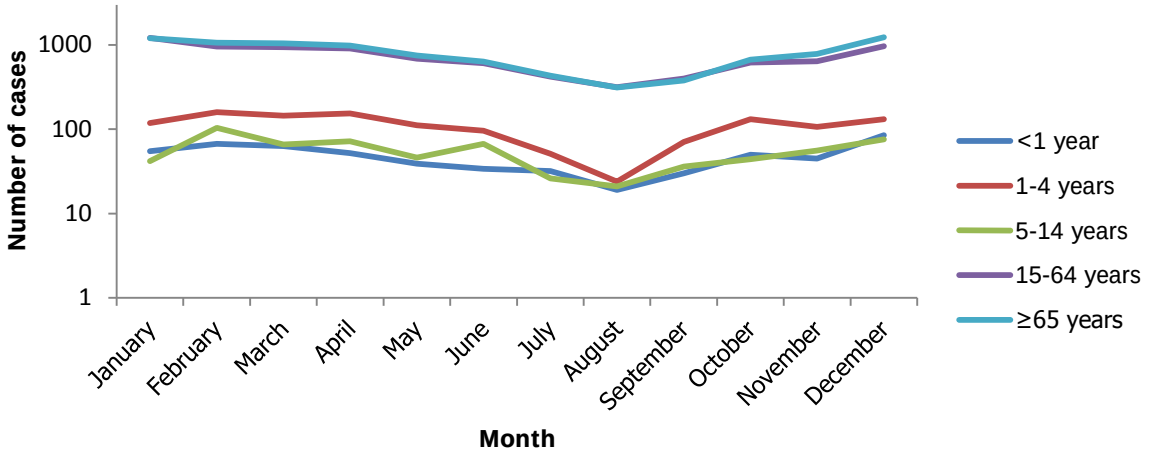


Figure 1.5 Distribution of reported IPD cases by month and age group (years), in EU/EEA countries, 2011 (n=20 708)



1.4.3 Age and gender

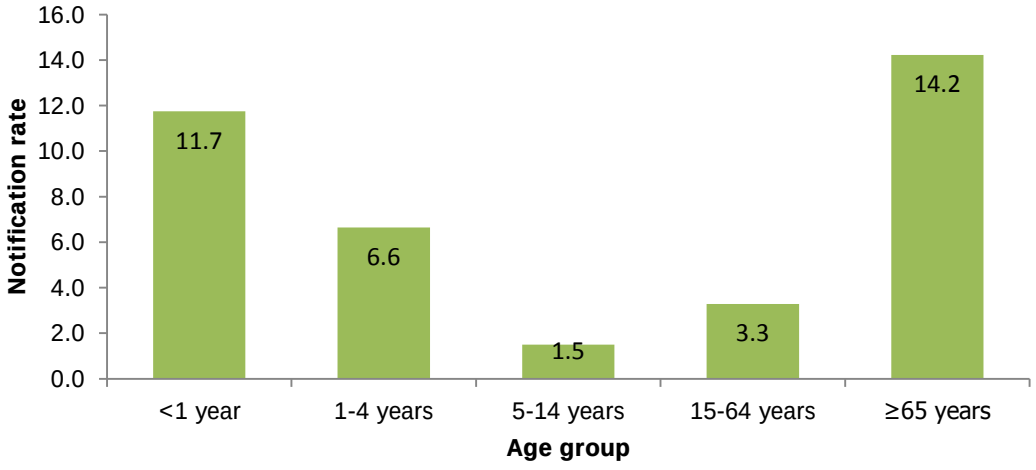
Of the 20 712 reported cases for which age information was provided (excluding aggregated data), 45.9% (n=9 503) related to people aged 65 years or older, 41.9% (n=8 680) to adults aged 15 to 64 years and 12.2% (n=2 529) to children 0 to 14 years. In the latter group, children aged one to four years accounted for the highest proportion of cases (6.3%, n=1 301) (Annex 1 Table A7).

Most countries reported a low proportion of cases in younger age groups and higher proportions in older age groups. Lithuania was the only country where at least 10% of cases were aged <1 year (33.3%). Slovenia reported the highest proportion of cases aged 1-4 years (18.4%). PCV is not part of the routine immunisation schedule in Slovenia. The highest proportion of cases aged 5-14 year years were reported by Romania (12.4%), Greece (12.2%) and Lithuania (11.1%), however the number of cases reported in these countries was low. Cyprus was the only country not to report cases aged 0–14 years (Annex 1 Table A7).

In 2011, the highest notification rates of IPD were seen in cases aged <1 (11.7 per 100 000) or ≥65 years (14.2 per 100 000) (Figure 1.6). From 2008–2011, there is a steady decline in the notification rate for cases aged <1 year. From 2009–2010 there was a notable increase in the notification rate of cases aged ≥65 years. Across all other age groups the trend was steady (Figure 1.7, Annex 1 Table A8).

Of the 20 744 reported cases where gender information was specified, 54.9% (n=11 392) were male and 45.1% (n=9 352) were female, corresponding to a 1.22:1 male/female ratio. In terms of the distribution of notification rates among the genders, male predominance was more evident in children under one year and in adults 65 years or over. There were slightly higher rates for males in all age groups (Figure 1.8).

Figure 1.6 Notification rate of reported IPD cases by age group, EU/EEA countries, 2011 (n=18 886*)



Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom

** Excludes aggregated data where different age groups were reported.*

Figure 1.7 Notification rate of reported IPD cases by age group, EU/EEA countries, 2011 (n=53 235)

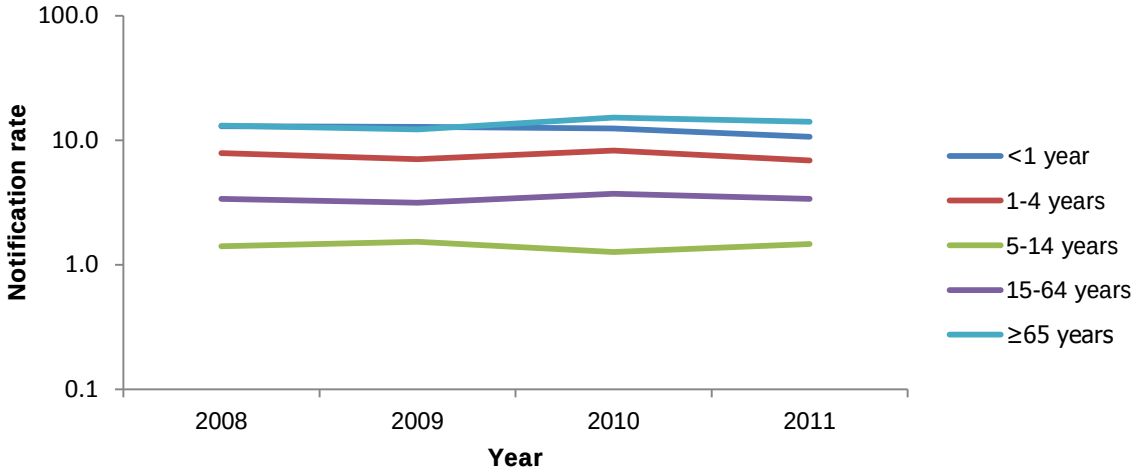
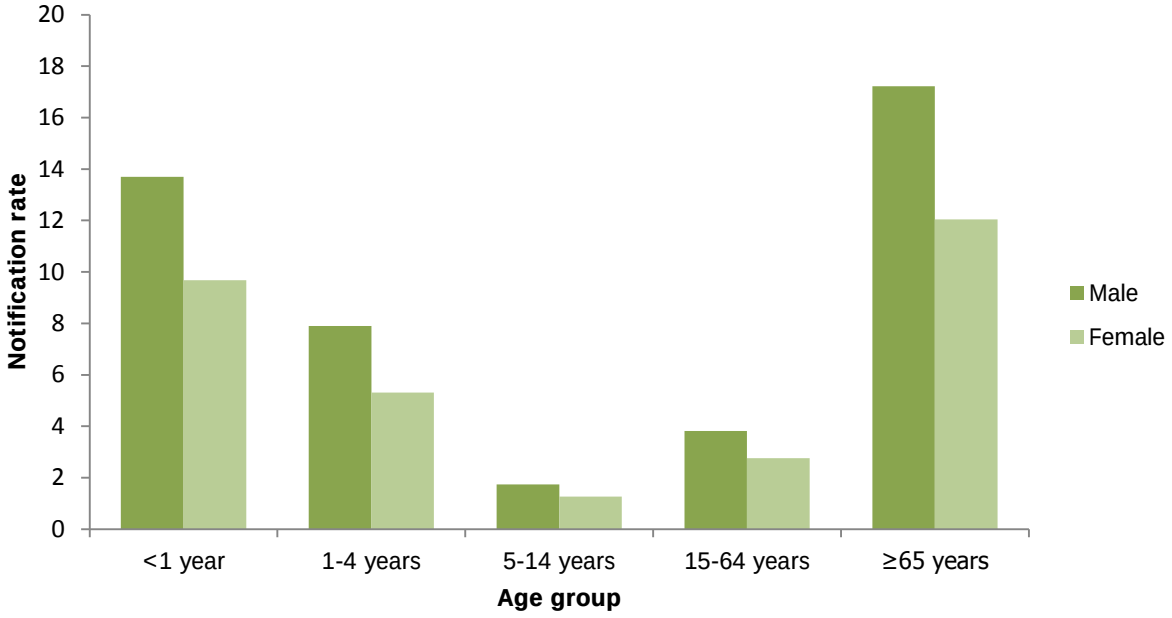


Figure 1.8 Notification rate of reported IPD cases by age group and gender, EU/EEA countries, 2011 (n=18 861*)



** Excludes 25 unknowns, data from Belgium and Cyprus for which rates of population coverage were unknown and aggregated data where different age groups were reported.*

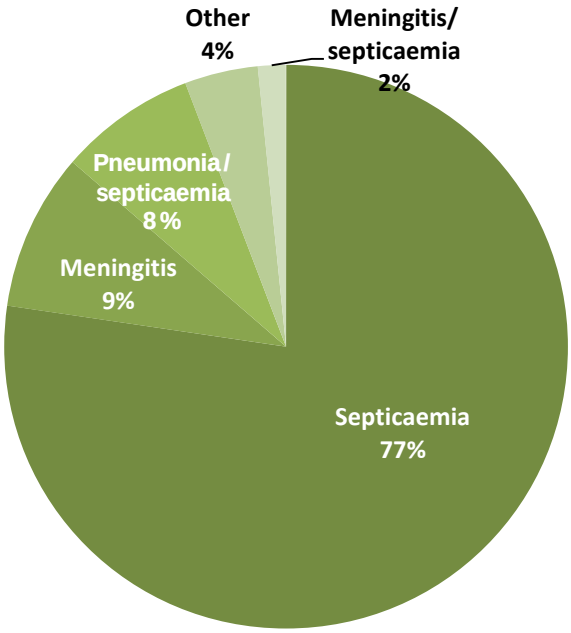
1.4.4 Clinical presentation

Of the 11 680 cases for which the clinical presentation was known (47.3% missing), septicaemia was the most frequent clinical presentation, accounting for 77% of all cases. No other clinical presentation accounted for as much as 10% of reported cases (Figure 1.9).

Where clinical presentation was known at country level, Belgium, Spain and the United Kingdom represented 83% of all cases of septicaemia. Septicaemia was also the only clinical presentation reported by Lithuania, and was reported in 92.4% of cases in Denmark. Meningitis was the most common clinical presentation in Greece (68.3%), Romania (57.8%) and Hungary (43.9%) (Annex 1 Table A9). In some countries bacterial meningitis is a notifiable disease whereas septicaemia is not.

Septicaemia was the most common clinical presentation across all age groups. Among all cases reporting septicaemia as a clinical presentation, those aged ≥65 accounted for 46.1% while those aged 15-64 accounted for 40.5%. Meningitis was the second most frequent clinical presentation for all age groups except among those aged 1-4 years and ≥65 years. In these age groups pneumonia/septicaemia was the second most common clinical presentation. Across all clinical presentations, cases aged over 15 years contributed to at least 68% of the data analysed (Table SP2). These results may be biased by the type of surveillance system in place.

Figure 1.9 Distribution of reported IPD cases by clinical presentation, 2011 (n=11 680)



Note: In the data collection for this report the clinical presentation of cases could not be recorded as 'bacteraemia' or 'bacteraemia/pneumonia'. Instead 'septicaemia' or 'setpicaemia/pneumonia' were available. Therefore cases of bacteraemia or bacteraemia/pneumonia may be reported as septicaemia or septicaemia/pneumonia.

Table 1.2 Distribution of reported IPD cases by clinical presentation and age group, EU/EEA countries, 2011 (n=11 637)

Age group	Meningitis/ septicaemia		Meningitis		Septicaemia		Pneumonia/ septicaemia		Other		Total
	N	%	N	%	N	%	N	%	N	%	N
<1 year	29	8.0	62	17.1	250	69.1	8	2.2	13	3.6	362
1-4 years	27	3.1	68	7.8	661	76.2	80	9.2	31	3.6	867
5-14 years	3	0.7	69	16.4	287	68.2	40	9.5	22	5.2	421
15-64 years	91	1.9	538	11.1	3 647	75.1	365	7.5	217	4.5	4 858
≥65 years	37	0.7	311	6.1	4 152	81.0	422	8.2	207	4.0	5 129
Total	**187**	**1.6**	**1 048**	**9.0**	**8 997**	**77.3**	**915**	**7.9**	**490**	**4.2**	**11 637**

Note: In the data collection for this report the clinical presentation of cases could not be recorded as 'bacteraemia' or 'bacteraemia/pneumonia'. Instead 'septicaemia' or 'setpicaemia/pneumonia' were available. Therefore cases of bacteraemia or bacteraemia/pneumonia may be reported as septicaemia or septicaemia/pneumonia.

1.4.5 Case–fatality rate

Nineteen countries reported data on outcome but the completeness for this variable differed widely from country to country. The overall CFR in EU/EEA countries was 10.3% (n=5 771). Cyprus and Denmark reported no deaths. The case–fatality rate ranged from 0% for Cyprus and Denmark to 28.6% for Lithuania (Annex 1 Table A10) and was highest among cases where the clinical presentation was meningitis (15.2%) (Annex 1 Table A11). Age-specific case–fatality rates were highest among cases aged over 65 years (14.3%) (Annex 1 Table A12).

Data on CFR should be interpreted with caution because data for the variable 'outcome' was significantly incomplete (overall missing 72.2%). Moreover, in Europe there is no common approach to the follow-up time or end-point for a fatal outcome.

1.4.6 Vaccination status

Vaccination status was known in only 14.5% of the reported cases. Of the 3 222 cases for which vaccination status was reported, 9.2% (n=298) were fully vaccinated, 1.2% (n=38) partially vaccinated and 89.6% (n=2 886) unvaccinated according to the respective national schedules. IPD in fully vaccinated cases may be caused serotypes not covered by the vaccine given and so does not constitute vaccine failure, while the timing of vaccination should also be considered. The completeness of this variable needs to be improved for more accurate conclusions to be drawn.

1.4.7 Serotypes

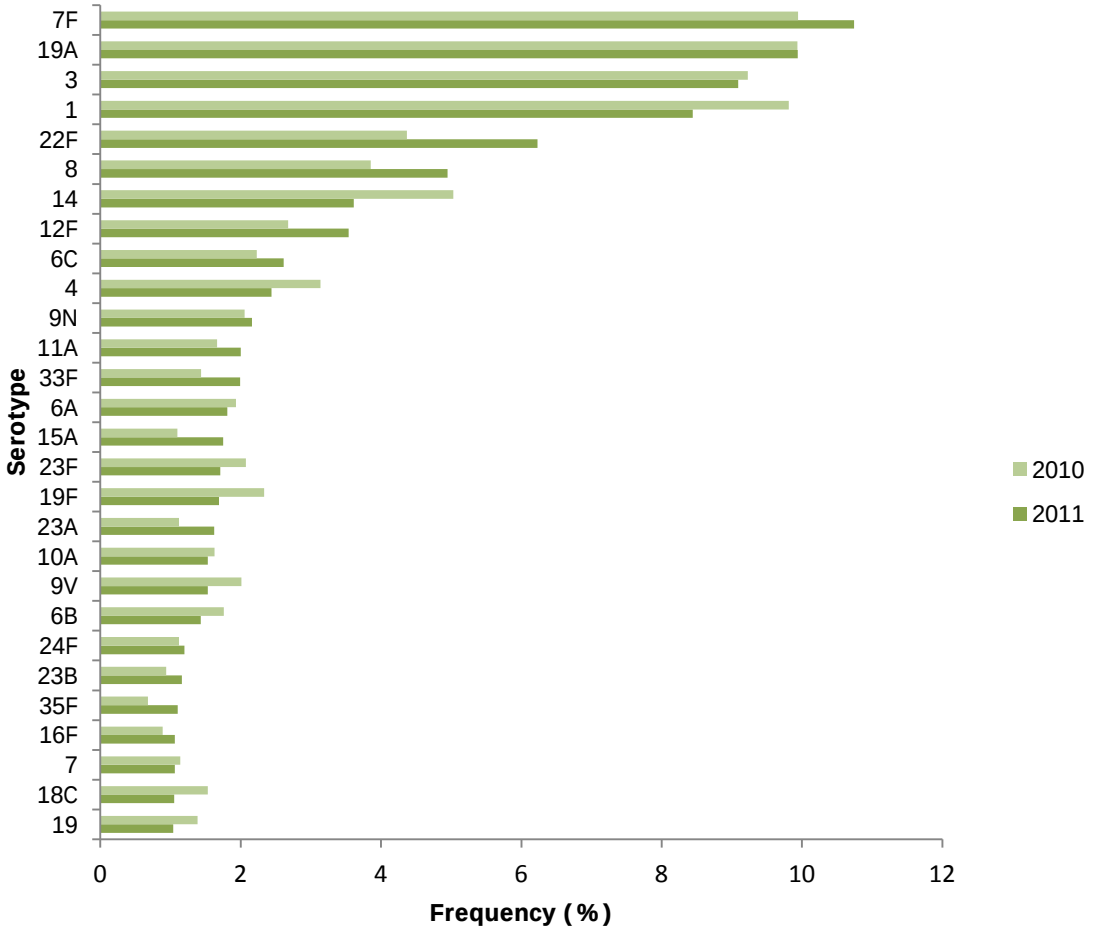
Most common serotypes

Of the 20 843 reported confirmed cases of invasive pneumococcal disease, 15 339 (73.6%) had included information on the isolate serotype. Of these, the ten most common serotypes were 7F, 19A, 3, 1, 22F, 8, 14, 12F, 6C and 4 accounting for 61.6% (n=9 446) of the typed isolates reported (Figure 1.10).

The most prevalent serotypes were 7F (n=1 647), 19A (n=1 525) and 3 (n=1 394), accounting for 10.7%, 9.9% and 9.1% of the total number of serotyped reported cases respectively. These were also the three most common serotypes in 2010. Serotype 22F showed the largest proportional increase from 2010 (4.37%) to 2011 (6.23%), followed by serotype 8 (3.85% in 2010 to 4.95% in 2011). There were also notable rises in serotypes 12F (0.86% increase) and 7F (0.80% increase). Serotype 14 showed the largest proportional decrease (5.03% in 2010 to 3.61% in 2011) followed by serotype 1 (9.81% in 2010 to 8.44% in 2011). Fifteen isolates were non-typeable (NTYP) in 2011 (Figure 1.10).

Two serotypes included in the PCV7 vaccine, 14 and 4, occur in the ten most common serotypes in 2011. These serotypes were a particularly frequent occurrence in Finland, Iceland and Slovenia (Annex 1 Table A13). The four most common serotypes are included in either PCV10 (7F and 1) or PCV13 (19A and 3). All four serotypes were prominent across a wide range of countries. The remaining four serotypes in the top 10 (22F, 8, 12F and 6C) are not covered by any of the PCV vaccines, although 22F, 8 and 12F are covered by PPV23 (Annex 1 Table A13).

Figure 1.10 Distribution of reported IPD cases by most common serotype, EU/EEA countries, 2011 (n=15 339) and their reported distribution in 2010 (n=10 460)



Serotype and age

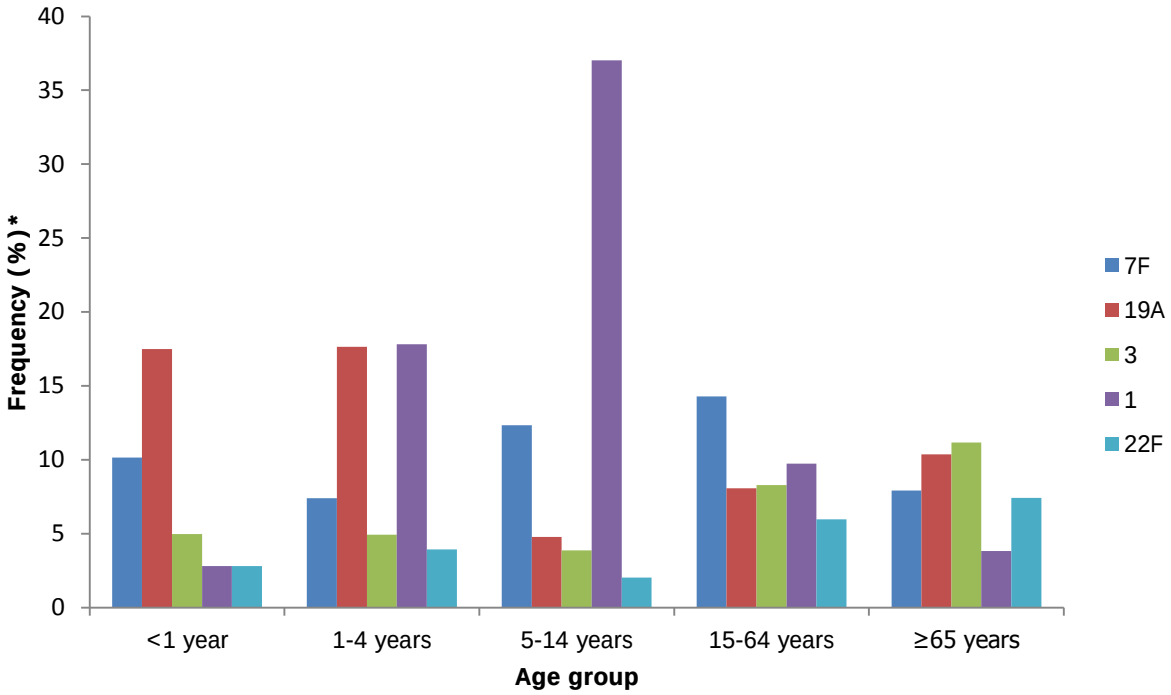
Of the 15 310 cases for which serotype and age were reported, serotype 19A was the most commonly reported in children under one year of age, followed by 7F. In children between one and four years of age, serotypes 19A and 1 were the most frequently reported, while serotype 1 contributed 37.0% of all serotypes isolated from cases in the 5–14 year-old age group (Figure 1.11, Annex 1 Table A14).

Among adult cases the serotypes were more evenly distributed, with serotype 7F most predominant in cases aged 15-64 years and serotype 3 most predominant in cases aged 65 years or older (Figure 1.11, Annex 1 Table A14).

Serotypes 7F, 19A, 1, 14 and 12F all contributed a greater proportion of cases aged <15 years, while serotypes 3, 22F, 8, 6C and 4 were more prominent in older age groups. It is noteworthy that serotypes 7F, 19A and 1 are the most prevalent serotypes in children under 15 years and these are not covered by PCV7 (Figure 1.11, Annex 1 Table A14).

Serotypes 7F and 3 were the most common in males, whereas serotypes 7F and 19A were the most frequent among females (Annex 1 Table A15).

Figure 1.11 Distribution of five most frequent IPD serotypes by age group, EU/EEA countries, 2011 (n=15 310)



** Frequency refers to the proportion of the total number of cases for which serotype information is available by age group*

Serotype and clinical presentation

Serotype information was available in 66.6% of the reported cases for which clinical presentation was known. Among the cases where serotype information and clinical presentation were known, in 81.6% the clinical presentation was septicaemia (n=8 336). Serotype 1 was the most frequently reported serotype among cases with septicaemia, followed by 7F and 19A. Serotype 3 was the most frequently reported serotype among two clinical presentations; meningitis (n=627) and meningitis/septicaemia (n=153), while serotype 7F was the most frequent serotype reported among cases with pneumonia/septicaemia (n=703) (Table SP3).

Table 1.3 Distribution of ten most frequent IPD serotypes by clinical presentation, EU/EEA countries, 2011 (n=10 214*)

Serotype	Meningitis/ septicaemia		Meningitis		Septicaemia		Pneumonia/ septicaemia		Other	
	N	%	N	%	N	%	N	%	N	%
7F	14	9.2	32	5.1	906	10.9	93	13.2	51	12.9
19A	11	7.2	57	9.1	844	10.1	85	12.1	47	11.9
3	17	11.1	79	12.6	736	8.8	90	12.8	49	12.4
1	2	1.3	19	3.0	950	11.4	76	10.8	22	5.6
22F	9	5.9	29	4.6	452	5.4	33	4.7	26	6.6
8	6	3.9	25	4.0	499	6.0	28	4.0	29	7.3
14	10	6.5	18	2.9	192	2.3	25	3.6	6	1.5
12F	5	3.3	11	1.8	258	3.1	21	3.0	10	2.5
6C	2	1.3	15	2.4	209	2.5	17	2.4	11	2.8
4	2	1.3	7	1.1	139	1.7	28	4.0	7	1.8
Total**	153		627		8 336		703		395	

** Overall 5 125 missing cases for clinical presentation among all serotypes: serotype 7F (N missing=551), 19A (n=481), 3 (n=423), 1 (n=225), 22F (n=406), 8 (n=173), 14 (n=302), 12F (n=238), 6C (n=147) and 4 (n=191).*

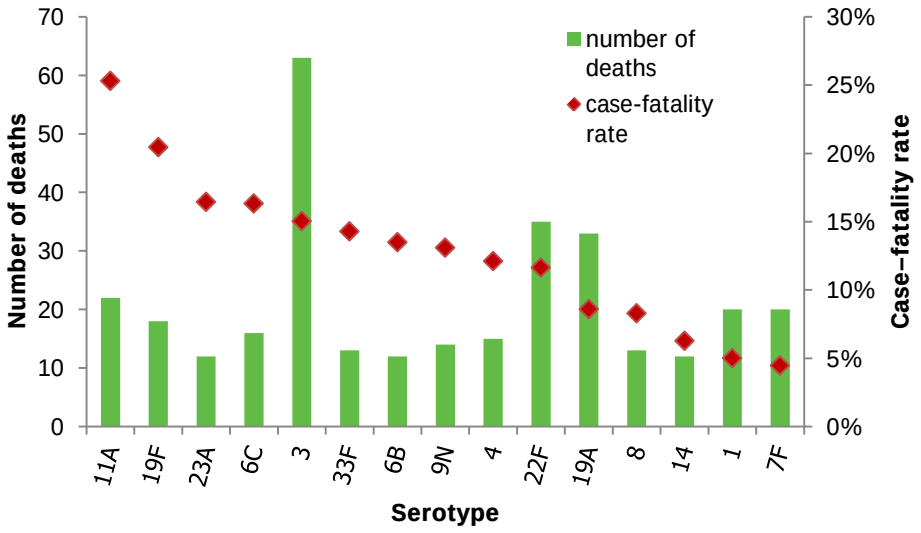
*** Total number of cases for which serotype information is available by clinical presentation*

Note: In the data collection for this report the clinical presentation of cases could not be recorded as 'bacteraemia' or 'bacteraemia/pneumonia'. Instead 'septicaemia' or 'septicaemia/pneumonia' were available. Therefore cases of bacteraemia or bacteraemia/pneumonia may be reported as septicaemia or septicaemia/pneumonia.

Serotype and case–fatality

Of 594 reported deaths, 80.8% had serotype data available (n=480). Serotype 3 accounted for the majority of reported deaths (n=63), followed by serotype 22F (n=35) and 19A (n=33) (Figure 1.12). Serotype 11A presented the highest serotype-specific case–fatality rate (25.3%) followed by serotype 19F (20.5%) and serotype 23A (16.4%). It is worth mentioning that serotype 23A is not covered by any of the licensed vaccines (PCV7, PCV10, PCV13 and PPV23). These serotypes occur mainly in the adult population (over 15 years) with the highest frequency in those aged ≥65 years.

Figure 1.12 Distribution of reported IPD case deaths (n=4 709*) and case–fatality rate by serotype, EU/EEA countries, 2011



** N refers to the total number of cases for which outcome and serotype information was known. In total 60 different serotypes were linked to a case death in 2011. Only the top 15 are shown here.*

Serotype and conjugate vaccines

Of all cases, 2.7% (n=409) were aged under 15 years and had serotype 1 infection. Serotype 1 is covered by PCV10 and 13. This was followed by serotype 19A (2.0%, n=300) which is only covered by PCV13.

Serotype 7F infection caused 10.8% (n=1 647) of cases across all age groups followed by 19A (10.0%, n=1 524), 3 (9.1%, n=1 390) and 1 (8.4%, n=1 290). All three of these serotypes are covered by either PCV10 and/or PCV13 (Table SP4).

Figure 1.13 suggests that PCV13 could have potentially prevented more than 50% of the cases occurring in children under one year of age. Overall, the potential coverage of PCV13 is higher than 50% in all age groups, (with the minor exception of cases aged ≥65 years (49.5%), while the coverage of PCV7 is below 15% for all age groups. Compared to 2010, a lower proportion of cases in all age groups were caused by a PCV10 or PCV13 serotype in 2011 (Figure 1.13, Figure 1.14).

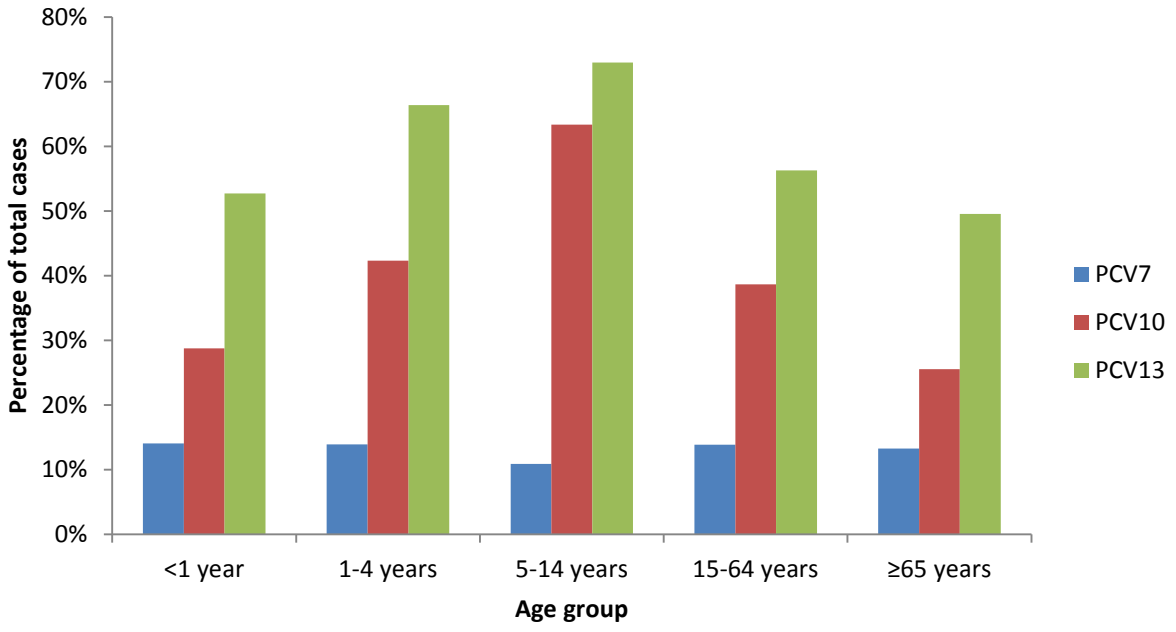
Among the non-PCV serotypes, serotype 22F (n=955) accounted for 6.2%, followed by serotype 8 (4.9%, n=757) and serotype 12F (3.5%, n=543) (Annex 1 Table A16).

Table 1.4 Distribution of reported PCV serotype IPD cases by age group for the three licensed PCV, EU/EEA countries, 2011 (n=15 310*)

PCV7 serotypes	PCV10 serotypes	PCV13 serotypes	Number and % of cases			
			<15 years		All age groups	
			N	%	N	%
4	4	4	18	0.1	374	2.4
6B	6B	6B	49	0.3	220	1.4
9V	9V	9V	17	0.1	235	1.5
14	14	14	88	0.6	553	3.6
18C	18C	18C	25	0.2	161	1.1
19F	19F	19F	41	0.3	259	1.7
23F	23F	23F	38	0.2	262	1.7
	1	1	409	2.7	1 290	8.4
	5	5	60	0.4	148	1.0
	7F	7F	195	1.3	1 647	10.8
		3	98	0.6	1 390	9.1
		6A	28	0.2	278	1.8
		19A	300	2.0	1 524	10.0

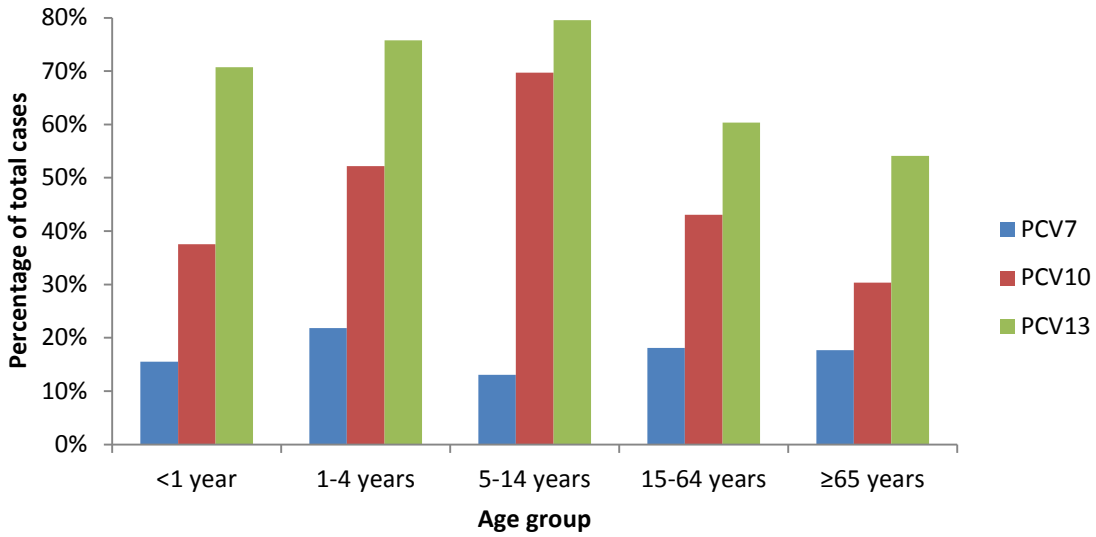
** Total cases across all age groups for which serotype and age information is available*

Figure 1.13 Percentage of cases covered by PCV serotype, by age group, EU/EEA countries, 2011 (n=15 310*)



** Total cases in each age group for which serotype and age information in available*

Figure 1.14 Percentage of cases covered by PCV serotype, by age group, EU/EEA countries, 2010 (n=10 410*)



** Total cases in each age group for which serotype and age information in available*

Serotype and polysaccharide vaccine

In the 15-64 year age range, 81.3% of the reported cases would have been covered and 72.7% of the reported cases aged 65 years or over (Table SP5).

Table 1.5 Distribution of PPV23 serotype IPD cases by age group, EU/EEA countries, 2011 (n=15 310*)

PPV23 serotype	Number and % of cases					
	15-64 years		≥65 years		All age groups	
	N	%	N	%	N	%
1	620	4.0	261	1.7	1290	8.4
2	1	0.0	1	0.0	2	0.0
3	528	3.4	764	5.0	1390	9.1
4	213	1.4	143	0.9	374	2.4
5	51	0.3	37	0.2	148	1.0
6B	63	0.4	108	0.7	220	1.4
7F	911	6.0	541	3.5	1647	10.8
8	423	2.8	309	2.0	757	4.9
9N	157	1.0	162	1.1	331	2.2
9V	116	0.8	102	0.7	235	1.5
10A	94	0.6	94	0.6	235	1.5
11A	120	0.8	160	1.0	307	2.0
12F	256	1.7	188	1.2	543	3.5
14	225	1.5	240	1.6	553	3.6
15B	48	0.3	64	0.4	142	0.9
17F	41	0.3	49	0.3	102	0.7
18C	79	0.5	57	0.4	161	1.1
19A	515	3.4	709	4.6	1524	10.0
19F	95	0.6	123	0.8	259	1.7
20	49	0.3	61	0.4	113	0.7
22F	381	2.5	507	3.3	955	6.2
23F	90	0.6	134	0.9	262	1.7
33F	106	0.7	154	1.0	306	2.0
Total	5182	81.3	4968	72.7	11 856	77.4

** Total cases across all age groups for which serotype and age information is available*

1.4.8 Antimicrobial resistance

Resistance to penicillin

In this report EUCAST clinical breakpoints[9] were used as a reference to determine resistance in IPD isolates. Eighteen countries (Table SP6 and Figure 1.15) reported 8 146 cases with SIR data on penicillin, with three countries (Belgium, France and Spain) reporting 67.1% (n=5 466) of the data. Overall, 82.9% (n=6 750) of cases were described as susceptible, 14.4% (n=1 171) as intermediate and 2.8% (n=225) as resistant to penicillin. In all, four countries observed a non-susceptibility level of <1% (Austria, Belgium, Estonia and Lithuania), although for Austria, Estonia and Lithuania the total number of isolates for which SIR antimicrobial resistance data was reported was low. The only other countries to report <10% non-susceptibility were Norway and the United Kingdom. High levels of resistance were observed in Romania (28.0%, n=25), Cyprus (25.0%, n=12) and Poland (20.0%, n=190), although in Romania and Cyprus the number of isolates tested was low (Table SP6).

Resistance to erythromycin

Eighteen countries (Table SP6 and Figure 1.15) reported 8 111 cases with SIR data on erythromycin and three countries (Belgium, France and Spain) reported 67.4% (n=5 466) of the data. Overall, 76.5% (n=6 201) of cases were described as susceptible, 0.1% (n=11) as intermediate and 23.4% (n=1 899) as resistant to erythromycin. Austria and Estonia presented <1% non-susceptibility although the total number of isolates for which SIR antimicrobial resistance data was reported was low. The only other countries to report <10% non-susceptibility were Norway and the United Kingdom. The highest percentage of resistance was reported from Romania (64.0%, n=25), although few isolates were tested, followed by Denmark (46.3%, n=95). Data from Denmark cannot be directly compared to the other countries since Denmark only reported full susceptibility data for isolates that had been screened as non-susceptible. This high percentage of resistance is therefore due to a reporting artefact. Overall, resistance to erythromycin can be regarded as common in Europe, with 15 countries reporting above 20% in 2011 (Table SP6).

Resistance to cefotaxime/ceftriaxone

Sixteen countries (Table SP6 and Figure 1.15) reported 7 206 cases with SIR data on cefotaxime/ceftriaxone, with three countries (Belgium, France and Spain) reporting 75.9% (n=5 466) of the data. Overall, 93.2% (n=6 719) were described as susceptible, 6.3% (n=455) as intermediate and 0.4% (n=32) as resistant to cefotaxime/ceftriaxone. Eleven countries reported <10% non-susceptibility, six of which observed <1%. Romania (20.0%, n=25) and Cyprus (8.3%, n=12) were the only countries to report resistance levels >2%, although the number of isolates for which SIR antimicrobial resistance data was reported was low (Table SP6).

Of the three antibiotics tested erythromycin demonstrated the highest percentage of resistance (23.4%, n=1 899). The overall percentage of non-susceptibility was 23.5% for erythromycin, 17.2% for penicillin and 6.7% for cefotaxime/ceftriaxone (Figure 1.15).

[9] http://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Breakpoint_tables/Breakpoint_table_v_3.1.xls

Table 1.6 Distribution of reported IPD cases by SIR (Susceptible, Intermediate or Resistant) scale and country, EU/EEA countries, 2011 (PEN n=8 146, ERY n=8 111, CTX/CFX n=7 206)

Antimicrobial	Penicillin				Erythromycin				Cefotaxime/ceftriaxone			
	%			N	%			N	%			N
Country	S	I	R	Total	S	I	R	Total	S	I	R	Total
Austria	100.0	0.0	0.0	4	100.0	0.0	0.0	1	NA	0.0	0.0	1
Belgium	99.2	0.1	0.8	1833	74.0	0.0	26.0	1833	99.8	0.2	0.0	1833
Cyprus	75.0	0.0	25.0	12	75.0	0.0	25.0	12	91.7	0.0	8.3	12
Denmark	54.7	43.2	2.1	95	52.6	1.1	46.3	95	95.8	4.2	0.0	95
Estonia	100.0	0.0	0.0	8	100.0	0.0	0.0	4	100.0	0.0	0.0	5
Finland	78.3	21.5	0.3	769	73.5	0.4	26.1	769	-	-	-	-
France	76.2	23.6	0.1	1413	74.0	0.5	25.5	1413	94.9	5.0	0.1	1413
Hungary	81.3	10.3	8.4	107	76.6	0.0	23.4	107	93.5	5.6	0.9	107
Ireland	79.5	15.2	5.3	283	81.6	0.0	18.4	282	92.2	6.0	1.8	283
Italy	85.9	7.0	7.0	71	74.3	0.0	25.7	70	-	-	-	-
Lithuania	100.0	0.0	0.0	3	66.7	0.0	33.3	3	66.7	33.3	0.0	3
Malta	50.0	37.5	12.5	8	72.7	0.0	27.3	11	70.0	30.0	0.0	10
Norway*	96.0	4.0	0.0	717	96.0	0.0	4.0	717	99.4	0.6	0.0	717
Poland	75.8	4.2	20.0	190	66.3	0.0	33.7	190	87.4	11.6	1.1	190
Romania	52.0	20.0	28.0	25	36.0	0.0	64.0	25	72.0	8.0	20.0	25
Slovakia	84.6	3.8	11.5	26	79.2	0.0	20.8	24	100.0	0.0	0.0	9
Slovenia	87.1	1.2	11.8	255	75.7	0.0	24.3	255	85.5	13.7	0.8	255
Spain	72.7	23.5	3.9	2220	76.0	0.0	24.0	2220	86.4	13.0	0.6	2220
United Kingdom	91.6	0.9	7.5	107	93.8	0.0	6.3	80	100.0	0.0	0.0	28
Total	**82.9**	**14.4**	**2.8**	**8 146**	**76.5**	**0.1**	**23.4**	**8 111**	**93.2**	**6.3**	**0.4**	**7 206**

- No data reported

** Reported MIC data interpreted to allow inclusion of data in sections entitled Resistance to penicillin, Resistance to erythromycin, Resistance to cefotaxime/ceftriaxone and Table SP7*

Resistance and serotype

Of the total number of serotyped isolates for which antimicrobial susceptibility information was provided (n=2104), 1 856 were reported with resistance (R) to erythromycin, 216 to penicillin and 32 to cefotaxime/ceftriaxone. Combined resistance to penicillin, erythromycin and cefotaxime/ceftriaxone (multi-drug resistance) was observed in serotypes 14, 19, 19A, 19F, 23F and 6B (Table SP9). In 2010, multi-drug resistance was observed to serotypes 14, 19A, 19F, 1, and 23F[10]. Dual resistance to penicillin and erythromycin was reported in serotypes 1, 11A, 15, 15A, 16F, 20, 23, 23A, 23B, 24, 24F, 3, 35B, 35C, 6A, 6C and 9V. For all three antimicrobials, serotype 19A represented the greatest proportion of resistant isolates, followed by serotype 14. Resistance to penicillin in serotype 1 was only reported in one isolate (Table SP7).

[10] http://ecdc.europa.eu/en/publications/Publications/invasive-pneumoccocal-disease-surveillance-2010.pdf

Table 1.7 Distribution of reported IPD cases by serotype and antimicrobial resistance, EU/EEA countries, 2011

Serotype	Penicillin R		Erythromycin R		Cefotaxime/ceftriaxone R	
	N	%	N	%	N	%
1^	1	0.5	158	8.5	-	-
3~	2	0.9	21	1.1	-	-
4*	-	-	7	0.4	-	-
5^	-	-	2	0.1	-	-
6	-	-	21	1.1	-	-
6A&	12	5.6	57	3.1	-	-
6B*	11	5.1	79	4.3	3	9.4
6C	4	1.9	90	4.8	-	-
7	-	-	1	0.1	-	-
7F^	-	-	9	0.5	-	-
8%	-	-	13	0.7	-	-
9	-	-	1	0.1	-	-
9A	-	-	3	0.2	-	-
9N%	-	-	7	0.4	-	-
9V*	14	6.5	23	1.2	-	-
10	-	-	1	0.1	-	-
10A%	-	-	4	0.2	-	-
11	-	-	3	0.2	-	-
11A%	6	2.8	14	0.8	-	-
11D	-	-	4	0.2	-	-
11F%	-	-	1	0.1	-	-
12	-	-	7	0.4	-	-
12F	-	-	5	0.3	-	-
14*	45	20.8	240	12.9	8	25.0
15	5	2.3	24	1.3	-	-
15A	4	1.9	100	5.4	-	-
15B%	-	-	21	1.1	-	-
15C	-	-	10	0.5	-	-
16F	1	0.5	8	0.4	-	-
17F%	-	-	8	0.4	-	-
18	-	-	1	0.1	-	-
18C*	-	-	1	0.1	-	-
19	1	0.5	98	5.3	1	3.1
19A~	63	29.2	491	26.5	15	46.9
19F*	22	10.2	93	5.0	2	6.3
20%	1	0.5	1	0.1	-	-
22	-	-	1	0.1	-	-
22F%	-	-	5	0.3	-	-
23	1	0.5	4	0.2	-	-
23A	3	1.4	24	1.3	-	-
23B	3	1.4	3	0.2	-	-
23F*	7	3.2	28	1.5	3	9.4
24	1	0.5	4	0.2	-	-
24A	-	-	1	0.1	-	-
24B	-	-	2	0.1	-	-
24F	2	0.9	57	3.1	-	-
28F	-	-	1	0.1	-	-
29	-	-	1	0.1	-	-
31	-	-	3	0.2	-	-
33	-	-	19	1.0	-	-
33F%	-	-	54	2.9	-	-
34	-	-	2	0.1	-	-
35	-	-	1	0.1	-	-
35B	4	1.9	9	0.5	-	-
35C	1	0.5	1	0.1	-	-
35F	-	-	1	0.1	-	-
38	-	-	1	0.1	-	-
NTYP	2	0.9	7	0.4	-	-
Total	**216**		**1 856**		**32**	

** Protected against by PCV7, 10 and 13 and PPV23 vaccines*
~ Protected against by PCV13 and PPV23 vaccine
% Protected against by PPV23 vaccine.
^ Protected against by PCV10 and 13 and PPV23 vaccines
& Protected against by PCV13 vaccine

Minimum inhibitory concentration (MIC)

Overall, for penicillin 72.6% of isolates were classed as susceptible (MIC ≤0.064 mg/L), 26.3% as intermediate and 1.0% as resistant (>2mg/L) (Table SP8). Resistance to penicillin ≥8mg/L was related to serotypes 14, 19A, 19F and 23F.

For erythromycin 75.0% of isolates were classed as susceptible (≤0.25 mg/L), 0.1% as intermediate and 24.9% as resistant (>0.5mg/L) (Table SP8). Resistance to erythromycin ≥32mg/L was related mainly to serotypes 19A, 19F, 15A, 6B, 6C, 24F, 14 and 33F.

For cefotaxime/ceftriaxone 90.1% of the isolates were classed as susceptible (≤0.5mg/L), 9.5% as intermediate and 0.4% as resistant (>2 mg/L) (Table SP8). Resistance to cefotaxime/ceftriaxone ≥4mg/L was related to serotypes 14 and 19A.

In total, 23.7% of reported cases were resistant to erythromycin and 0.4% resistant to cefotaxime/ceftriaxone.

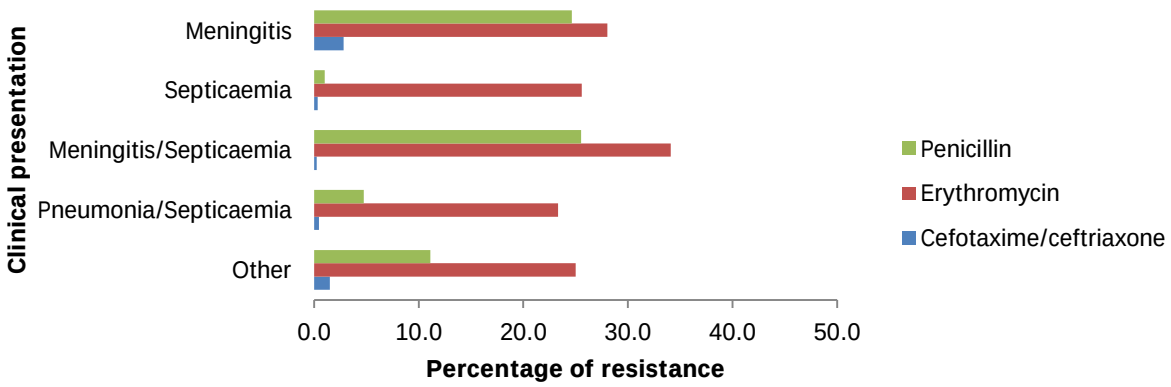
Table 1.8 Distribution of reported IPD cases by antibiotic and MIC, EU/EEA countries, 2011

MIC (mg/L)	Penicillin		Erythromycin		Cefotaxime/ceftriaxone	
	N	%	N	%	N	%
≤0.032	3 857	68.3	6	0.2	3 200	66.7
0.064	243	4.3	39	1.0	218	4.5
0.125	202	3.6	2 482	64.8	249	5.2
0.25	329	5.8	348	9.1	292	6.1
0.5	248	4.4	5	0.1	367	7.6
1	401	7.1	6	0.2	360	7.5
2	303	5.4	45	1.2	95	2.0
4	51	0.9	23	0.6	15	0.3
8	8	0.1	70	1.8	3	0.1
16	1	0.0	68	1.8		
32	1	0.0	47	1.2		
64			95	2.5		
>64			599	15.6		
Total	**5 644**		**3 833**		**4 799**	

Resistance and clinical presentation

Erythromycin resistance was the highest across all clinical presentations, with little variation observed in resistance levels between clinical presentations. Cefotaxime/ceftriaxone resistance levels were also relatively comparable between clinical presentations. Penicillin resistance was highest in cases with meningitis/septicaemia (25.5%) and meningitis (24.6%) (Figure 1.15).

Figure 1.15 Distribution of resistance for reported IPD cases by antibiotic and clinical presentation, EU/EEA countries, 2011 (PEN n=4 675, ERY n=4 668, CTX n=4 583)



Note: In the data collection for this report the clinical presentation of cases could not be recorded as 'bacteraemia' or 'bacteraemia/pneumonia'. Instead 'septicaemia' or 'setpicaemia/pneumonia' were available. Therefore cases of bacteraemia or bacteraemia/pneumonia may be reported as septicaemia or septicaemia/pneumonia.

S. pneumoniae results from EARS-Net compared with IPD antimicrobial susceptibility data

The Member States reported similar data for *Streptococcus pneumoniae* to the EARS-Net antimicrobial resistance surveillance database and to the IPD enhanced surveillance (see Annex 1 Table A17). For most countries, antimicrobial susceptibility testing results reported to EARS-Net correspond with the data reported to the IPD enhanced surveillance, despite some differences in the sources of these data. However, for a few countries there seem to be more significant differences in antimicrobial susceptibility testing results. This may be due to the fact that data reported to the IPD surveillance may, for some countries, be a subset of the data reported to EARS-Net. For other countries the data sources may be different or a low number of cases may be reported and thus, confidence intervals are too large to allow appropriate comparisons. Denmark reports a larger number of cases, however, Denmark only reported complete susceptibility data for isolates that had been screened as non-susceptible to the IPD enhanced surveillance, meaning that its results were biased towards a higher rate of non-susceptibility.

2. Invasive *Haemophilus influenzae* disease

2.1 Introduction

Invasive *Haemophilus influenzae* disease is a systemic infection caused by the bacterium *Haemophilus influenzae*, a common commensal of the upper respiratory tract. It represents an important public health problem, particularly in infants and children, with disease most common in children aged two months to five years. It is a significant cause of childhood bacterial meningitis and may also cause pneumonia, septicaemia and epiglottitis in addition to less severe upper respiratory tract infections. *H. influenzae* , is divided into non-capsulated (non-typeable) strains and capsulated strains. Capsulated strains are further split into six serotypes (a-f). *H.influenzae* serotype b (Hib) is the serotype most pathogenic to humans.

From the late 1990s, EU countries began introducing routine early childhood Hib vaccination into their national schedules. Before vaccination was implemented it was estimated that Hib caused >80% of invasive *H. influenzae* disease [37]. The vaccine has proven to be effective and has led to a progressive reduction in b-serotype infections [38] and as such the Hib vaccine remains of paramount importance in order to protect children from the disease. There is still concern about the possibility of serotype replacement with other *H. influenzae* strains, which will have an impact on the long term effectiveness of the vaccine [39–42], although current literature suggests that there has been no evidence of this since the introduction of the vaccine into national immunisation schedules [43–44].

2.2 Main points

- Overall, 2 152 confirmed cases of invasive *H. influenzae* disease were reported by 24 EU/EEA countries in 2011.
- The notification rate across Europe was 0.58 cases per 100 000 population, ranging from 2.16 (Sweden) to 0.01 (Greece). It appears to be a rare disease in the majority of the Member States.
- There was a clear seasonal distribution of cases with a noticeable rise during the winter months.
- Of all cases reported in 2011, 48.3% were among adults 65 years of age and older, although notification rates were higher among infants. Males were affected more often than females. Notification rates across all age groups have remained relatively stable since 2008.
- Non-capsulated strains made up 77% of cases, with non-b serotypes causing 16% and serotype b 7%, although serotype was unknown for 50.7% of cases.
- Notification rates of non-capsulated strains were highest among cases aged under one year (1.62 per 100 000), for which the trend fluctuated over time. There was a slight increase in cases aged 15–64 years. Overall there is an upward trend in non-capsulated strains.
- A decrease in serotype b infections was observed during 2008–2011 in cases under five years of age, with the total number of cases in 2011 decreasing to less than half the total observed in 2008. This trend was most notable in cases aged under one year.
- Between 2008 and 2011, only three countries reported notification rates of serotype b infection >1 per 100 000 in cases aged under five years; Lithuania (2008), the Netherlands (2009 and 2010) and Estonia (2011).
- Among serotype non-b infections there was a decrease in cases under one year of age and an increase in cases aged 65 years and above. Serotype f represented 69.6% of non-b serotypes.
- More robust surveillance data is needed for serotype replacement in invasive *H. influenzae* disease to be accurately assessed, particularly with regard to serotype data.
- Septicaemia was the reported clinical presentation in 64% of cases. The highest proportion of cases due to meningitis and pneumonia was in cases aged 1-4 years.
- The overall CFR in EU/EEA countries was 11.0%, and was highest in cases aged under one year (19.5%). When analysed by serotype, infections caused by non-capsulated strains had the highest CFR (13.8%), as has been described in the literature.
- There was a high proportion of missing data for the following variables: vaccination status, outcome, clinical presentation and serotype. Results that incorporate these variables must be interpreted with caution. Differences between surveillance systems should be considered for all variables.

2.3 Methods: data analysis and quality

2.3.1 Data source

Among those countries that reported confirmed cases in 2011, comprehensive surveillance systems are in place with sentinel surveillance data reported by Belgium, Cyprus, France, the Netherlands and Spain. According to the data source profiles uploaded by countries, 17 countries had a reconciled notification/laboratory surveillance system (meaning that laboratory data and epidemiological and/or vaccination information are collected and filed together on a case-by-case basis at national level). Five countries only had laboratory-based surveillance systems and five countries only presented data from a notification system.

Due to the potential overlap of data sources, surveillance system, population coverage or age restrictions, the following criteria were applied for specific countries when analysing data for invasive *H. influenzae* disease:

- In France, data on invasive *H. influenzae* disease are reported through a sentinel surveillance system, FR-EPIBAC. The population coverage rate from this data source was declared (Annex 2 Table B2) and was applied for the analysis of notification rates.
- In Spain, data on invasive *H. influenzae* disease are reported through a sentinel surveillance system, ES-MICROBIOLOGICAL. The overall population coverage of this data source was reported at 33% of the total population in 2011, which was applied for the analysis of notification rates.
- Belgium reported sentinel surveillance data, for which the population coverage was unknown and so data from Belgium were excluded from the notification rates analysis.
- Cyprus reported sentinel surveillance data, for which the population coverage was unknown and so data from Cyprus were excluded from the notification rates analysis.
- For the Netherlands, only data reported from the sentinel surveillance source NL-NRBM were included in this report, while data from NL-OSIRIS were excluded as the data are less complete. In previously published IBD reports, data from NL-OSIRIS were used.
- Aggregated data was reported by Bulgaria and were included where possible.

This report includes the total number of reported, confirmed cases of invasive *H. influenzae* disease and a description of epidemiological and laboratory variables with appropriate completeness. Statistical analysis was performed using STATA® 12.0 (StataCorp, USA) and data are presented with the 'date used for statistics' as the preferred date. This is the date that the country chooses as its preferred date for reporting and could be date of disease onset, date of diagnosis, date of notification, or any other date that the country may use nationally.

Notification rates were calculated by using numbers of cases as the numerator and total population, or surveillance system population coverage, as the denominator. Countries that reported sentinel surveillance include Belgium, Cyprus, France, the Netherlands and Spain. France, the Netherlands and Spain reported the level of population coverage in their sentinel systems and so were included in the notification rates analysis. Notification rates for these countries should be interpreted with caution. The level of population coverage in Belgium and Cyprus was not known and so these countries were not included in the notification rates analysis. For figures or tables where notification rates over time are considered, only countries that reported for all the displayed years were included. In these cases countries are listed below the respective figure/table.

There is no common definition of the point in time at which a fatal outcome is determined. This may add variation to the outcome figures throughout Europe. Acknowledging the differences in invasive *H. influenzae* disease surveillance systems and reporting across Europe, CFR was calculated on a country basis. Serotype-specific case–fatality rate was calculated following the same rule. Consequently only cases with known outcomes were considered. Unless presented, all other 'unknown' and 'missing' responses were excluded from analysis. For clinical presentation, cases with clinical presentation reported as 'Not Under Surveillance' were excluded.

The vaccination status 'fully vaccinated' and 'partly vaccinated' were defined by the reporting country according to its immunisation schedule.

2.3.2 Data quality

In 2011, 2 152 confirmed cases of invasive *H. influenzae* disease were reported by 24 countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, and United Kingdom. Latvia, Malta and Slovakia all reported data, but did not report any confirmed cases. Germany, Liechtenstein and Luxembourg did not report data on invasive *H. influenzae* disease in 2011. Data from 2011 was not reported by Germany due to technical problems. Data on invasive *H. influenzae* disease from Germany for 2011 will appear in future reports.

Data on serotypes were reported by 20 countries: Austria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and United Kingdom.

All cases considered for inclusion in the analysis were laboratory-confirmed cases. All countries reported case-based data except Bulgaria, which submitted aggregated data.

Data on the variables age, age month, gender, classification and specimen were complete, or almost complete, although there was a slight increase in the overall amount of missing data for these and other variables. Only serotype (50.7% missing in 2011, 56.3% missing in 2010) and TestMethod (14.7% missing in 2011, 17.3% in 2010) showed improvements in terms of data completion. Data on vaccination status was the least complete, representing 12.7% of the total reported cases (Annex 2 Table B3).

2.3.3 Laboratory methods used for strain identification

Specimens

Blood isolates accounted for 86.3% (n=1 756) of the total number of cases for which the specimen was reported (n=2 034). Cerebrospinal fluid was reported in 7.8% (n=158) of cases and 'other sterile site' in 5.9% (n=120) (Annex 2 Table B4). Blood specimens made up ≥65% of specimens in all age groups. Children aged 1-4 years showed the highest proportion of CSF isolates by age group (24.8%). Cases aged over 15 years represented 85.6% of the data (Annex 2 Table B5).

Test method

Laboratory methods used to detect the pathogen include: culture, serology, immunology tests, antigen detection, detection of nucleic acid, genotyping and sequencing.

Information on test method was available for 85.3% of cases from 19 countries. Culture was the most frequently reported method, accounting for 93.9% of tests, and the only method reported by 11 countries (Figure 2.1)

Figure 2.1 Proportion of strain identification methods used on primary specimen for cases reported as invasive *H. influenzae* disease by country, in EU/EEA countries, 2011 (n=1 941)

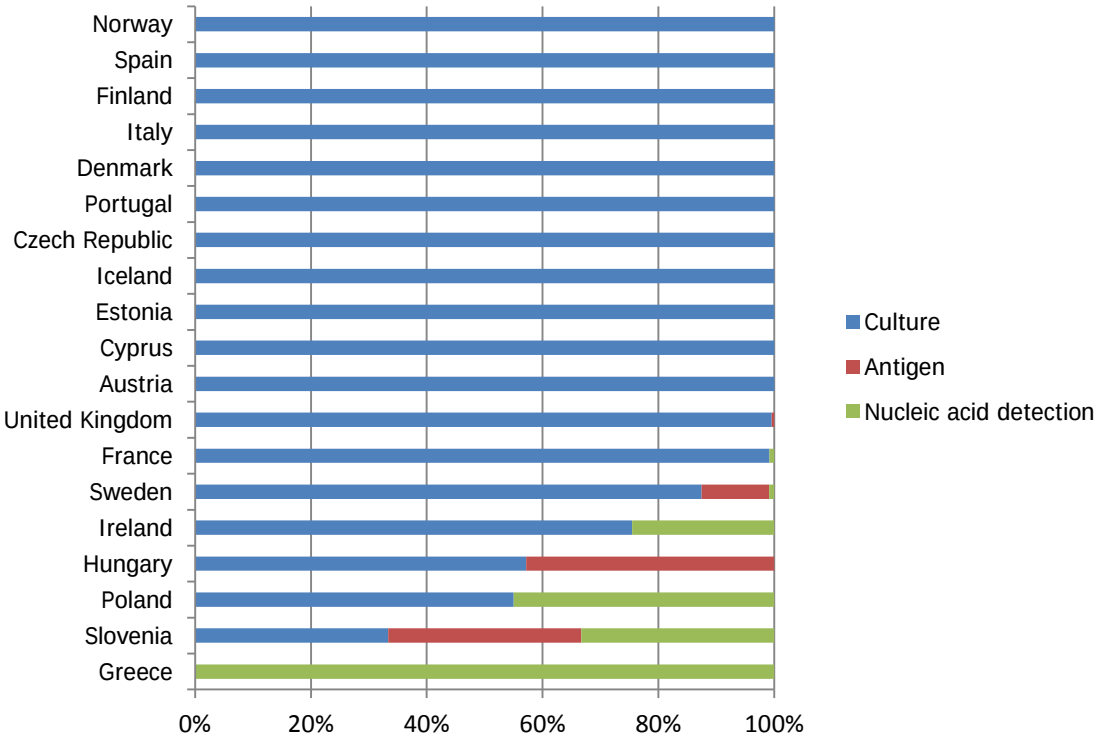


Table 2.1 Number of reported cases and notification rates (cases per 100 000 population) of invasive *H.influenzae* disease cases in EU/EEA countries, 2008-11.

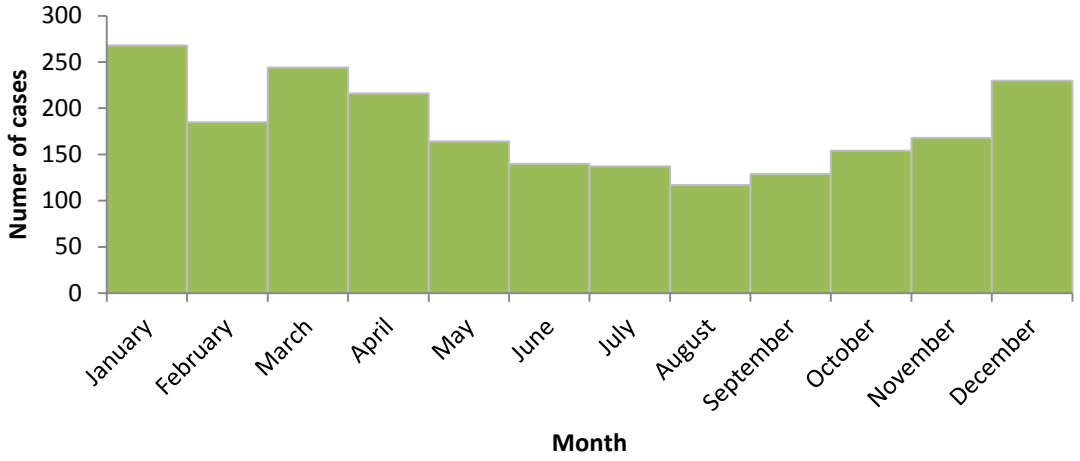
Country	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
Austria	5	0.06	14	0.17	2	0.02	3	0.04
Belgium	49	0.45	76	0.69	68	0.62	96	0.88
Bulgaria	7	0.09	10	0.13	22	0.29	2	0.03
Cyprus	0	0.00	2	0.24	3	0.36	1	0.12
Czech Republic	7	0.07	10	0.09	22	0.21	15	0.14
Denmark	32	0.58	31	0.56	43	0.77	47	0.85
Estonia	1	0.07	1	0.07	1	0.07	2	0.15
Finland	45	0.84	47	0.87	40	0.74	66	1.23
France	422	0.89	417	0.88	371	0.78	492	1.04
Greece	4	0.04	13	0.11	4	0.04	1	0.01
Hungary	6	0.06	3	0.03	5	0.05	8	0.08
Ireland	22	0.49	43	0.96	26	0.58	44	0.98
Italy	50	0.08	56	0.09	69	0.11	47	0.08
Latvia	1	0.04	1	0.04	0	0.00	0	0.00
Lithuania	3	0.09	1	0.03	1	0.03	2	0.06
Malta	0	0.00	3	0.72	2	0.48	0	0.00
Netherlands	109	0.65	124	0.74	144	0.86	137	0.82
Poland	28	0.07	19	0.05	25	0.07	22	0.06
Portugal	5	0.05	8	0.08	10	0.09	22	0.21
Romania	2	0.01	22	0.10	19	0.09	10	0.05
Slovakia	4	0.07	5	0.09	3	0.06	0	0.00
Slovenia	12	0.59	18	0.88	15	0.73	22	1.07
Spain	73	0.48	53	0.35	78	0.51	77	0.51
Sweden	163	1.73	146	1.55	179	1.90	203	2.16
United Kingdom	733	1.17	742	1.19	622	1.00	746	1.19
EU Total	**1 783**	**0.50**	**1 865**	**0.52**	**1 774**	**0.49**	**2 065**	**0.57**
Iceland	0	0.00	0	0.00	0	0.00	2	0.63
Norway	75	1.52	71	1.44	89	1.81	85	1.73
Total	**1 858**	**0.50**	**1 936**	**0.52**	**1 863**	**0.50**	**2 152**	**0.58**

** Aggregated reporting*
^ Sentinel surveillance, population coverage unknown so notification rate not included
 # Sentinel surveillance, population coverage known
~ There is no single surveillance system in the UK. Data are representative (as submitted by England and Wales, Scotland and Northern Ireland), however surveillance systems might not be identical.
Note – Data from Germany are not shown as Germany was unable to upload data to TESSy for 2011 due to technical problems. Data on invasive H. influenzae disease from Germany for 2011 will appear in future reports.

2.3.4 Seasonality

The seasonal distribution of cases of invasive *H. influenzae* disease follows a pattern similar to that for other respiratory diseases. In 2011, the highest rates were observed during the winter months, with rates decreasing in the summer, as observed in previous years (Figures HI2). Seasonality by country is presented in Annex 2, Table B6.

Figure 2.2 Distribution of reported invasive *H. influenzae* cases by month, in EU/EEA countries, 2011 (n=2 152)



2.3.5 Age and gender

Of the 2 138 reported cases for which age information was provided (excluding aggregated data), 48.3% (n=1 032) concerned people aged 65 years or older, 37.4% (n=799) concerned adults aged 15 to 64 years and 14.4% (n=307) concerned children 0 to 14 years of age. In the latter group, children aged less than one year accounted for the highest proportion of cases (6.5%, n=139) (Annex 2 Table 7).

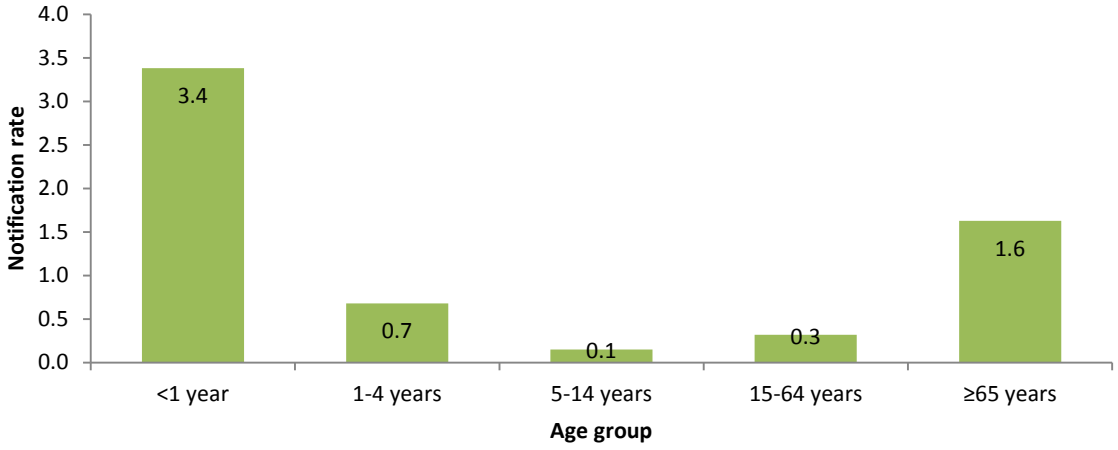
In general, most countries reported similar proportions in the different age groups, except for countries reporting low numbers of cases. Most countries reported a high proportion of cases in older age groups and lower proportions in younger age groups. In fourteen countries at least 40% of the cases were aged 65 years or older, with the highest proportions reported in Denmark (59.6%, n=47) and Sweden (59.6%, n=203). Only nine countries reported more than 20% of the cases aged 14 or under (Annex 2 Table B7).

The notification rate was highest among cases aged <1 year (3.4 per 100 000), followed by those aged ≥65 years (1.6 per 100 000) (Figure 2.3). During the period 2008–2011, the notification rate among cases aged <1 year was consistently the highest reported. Trends were relatively stable across all age groups (Figure 2.4, Annex 2 Table B8).

Of the 2 133 reported cases for which gender information was available, 50.6% (n=1 080) were male and 49.4% (n=1 053) were female, corresponding to a male/female ratio of almost 1:1.

Regarding the distribution of notification rates by gender, male predominance was more evident in children under one year and adults aged 65 years or over. Males showed slightly higher rates than females in all age groups (Figure 2.5).

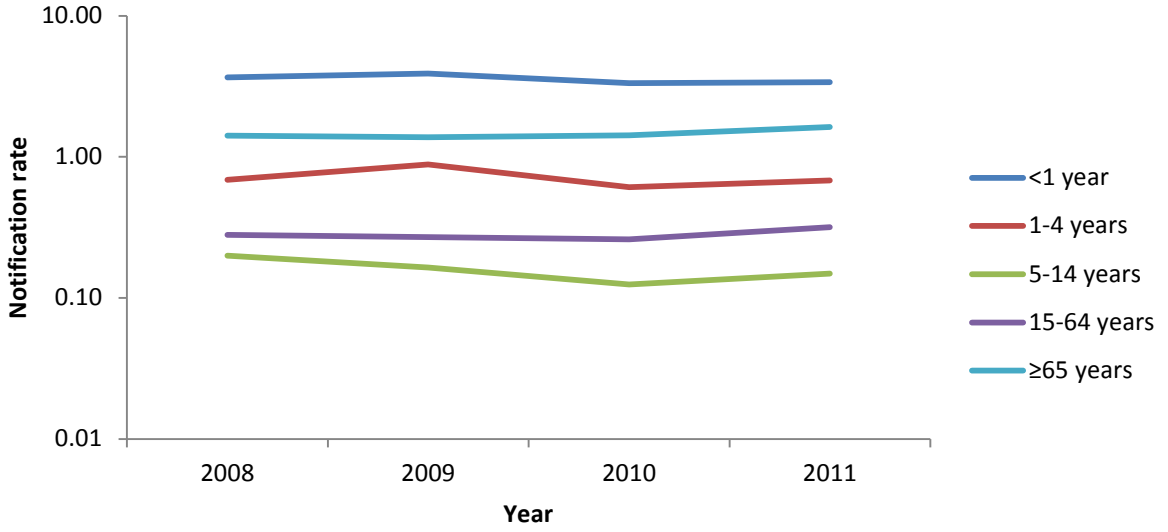
Figure 2.3 Notification rate of reported invasive *H. influenzae* cases by age group, EU/EEA countries, 2011 (n=2 044*)



Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

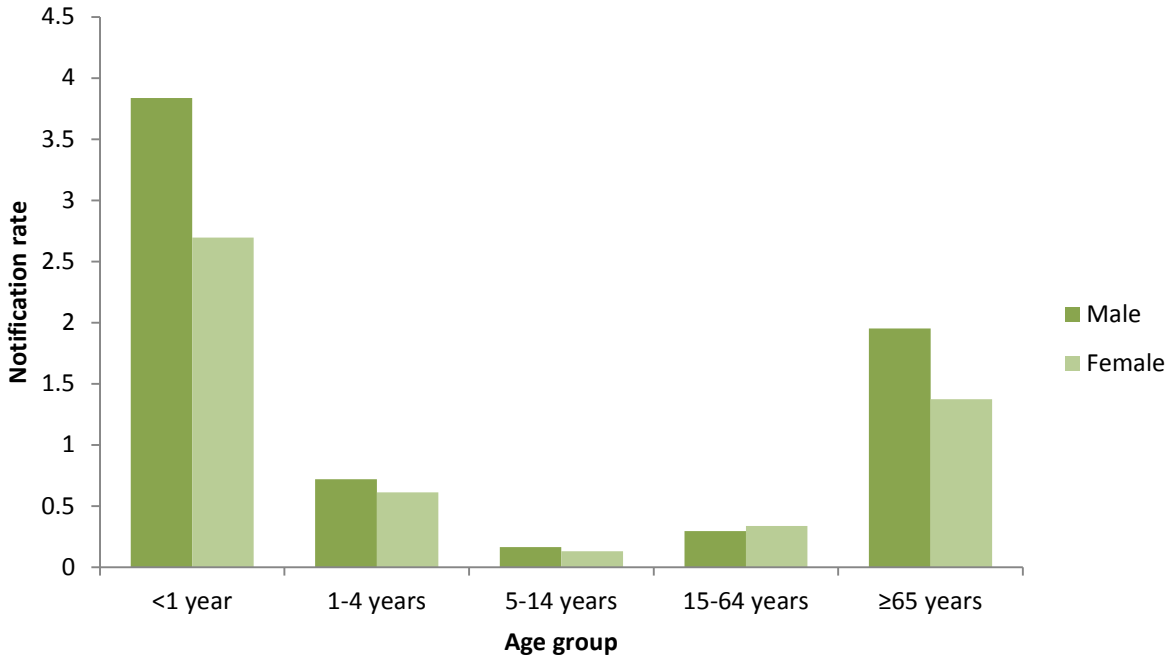
** Excludes aggregated data where different age groups were reported*

Figure 2.4 Notification rate of reported invasive *H. influenzae* cases by age group, EU/EEA countries, 2008-11 (n=7 491)



Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Figure 2.5 Notification rate of reported invasive *H. influenzae* cases by age group and gender, EU/EEA countries, 2011 (n=2 044*)



** Excludes 18 cases without age information, data from Belgium and Cyprus for which rates of population coverage were unknown and aggregated data where different age groups were reported.*

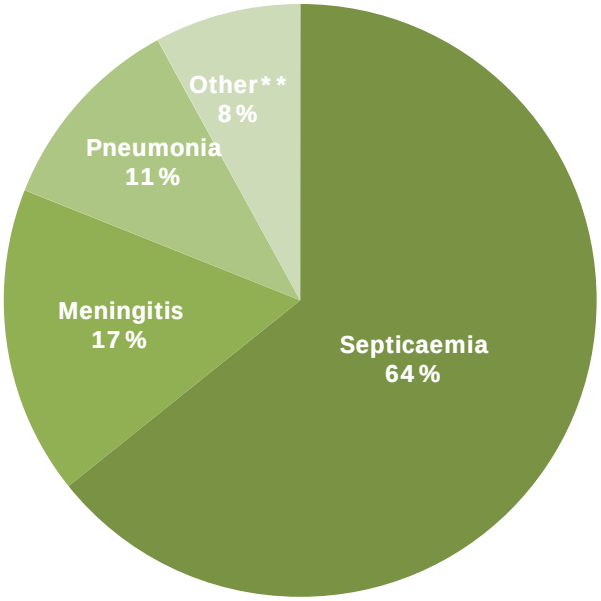
2.3.6 Clinical presentation

Among the 702 cases for which information on clinical presentation was available (67.4% missing or recorded as not under surveillance), septicaemia was the most frequent clinical presentation accounting for 64% of the cases, followed by meningitis (17%) (Figure 2.6).

For all cases with known clinical presentation by country, France and the United Kingdom contributed to 69% of all data. The UK alone contributed to 72% of septicaemia cases. France reported the highest number of cases with meningitis (n=46) and pneumonia (n=25). Seven of the 15 countries that submitted data on clinical presentation reported on less than 10 cases (Annex 2 Table B9).

Among cases with information on clinical presentation, 80.8% were aged over 15 years. Septicaemia was the most common and meningitis the second most common clinical presentation across all age groups (Table HI2). Data on clinical presentation can be biased by the type of surveillance system in place.

Figure 2.6 Distribution of reported invasive *H. influenzae* cases by clinical presentation, 2011 (n=702*)



** Excludes cases reported as NUS (Not Under Surveillance)*

*** 'Other' includes cases where clinical presentation was recorded as other, meningitis/septicaemia, cellulitis or osteomyelitis/septic arthritis as the number of reported cases of the latter three was very low (Annex 2, Table B9)*

Table 2.2 Distribution of reported invasive *H. influenzae* cases by clinical presentation and age group, EU/EEA countries, 2011 (n=702)

Age group	Septicaemia		Meningitis		Pneumonia		Other		Meningitis/ septicaemia		Cellulitis		Osteomyelitis /septic arthritis		Total
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
<1 year	48	69.6	15	21.7	2	2.9	3	4.3	1	1.4	0	0.0	0	0.0	69
1-4 years	17	41.5	12	29.3	5	12.2	5	12.2	1	2.4	0	0.0	1	2.4	41
5-14 years	15	60.0	4	16.0	2	8.0	3	12.0	0	0.0	1	4.0	0	0.0	25
15-64 years	152	57.1	61	22.9	22	8.3	30	11.3	1	0.4	0	0.0	0	0.0	266
≥65 years	219	72.8	26	8.6	46	15.3	8	2.7	0	0.0	1	0.3	1	0.3	301
Total	**451**	**64.2**	**118**	**16.8**	**77**	**11.0**	**49**	**7.0**	**3**	**0.4**	**2**	**0.3**	**2**	**0.3**	**702**

2.3.7 Case–fatality rate

Seventeen countries reported data on outcome but the completeness for this variable differed widely from country to country. The overall CFR in EU/EEA countries was 11.0% (n=1 142). The highest CFR was observed in Italy (24.2%, n=8). No deaths were reported from seven countries (Annex 2 Table B10). CFR was similar among different clinical presentations (Annex 2 Table B11), while the greatest CFR was observed among cases aged <1 year (19.5%) followed by cases aged ≥65 years (15.0%) (Annex 2, Table B12).

Data on CFR should be interpreted with caution because data for the variable 'outcome' was significantly incomplete (overall missing 46.9%). Moreover, in Europe there is no common approach to the follow-up time or end-point for a fatal outcome.

2.3.8 Vaccination status

Hib vaccination is part of the routine immunisation schedule, in all EU/EEA Member States[11]. Vaccination status was only known in 50% (n=40) of all cases of serotype b invasive *H. influenzae* disease. The completeness of this variable needs to be improved for more accurate conclusions to be drawn.

2.3.9 Serotypes

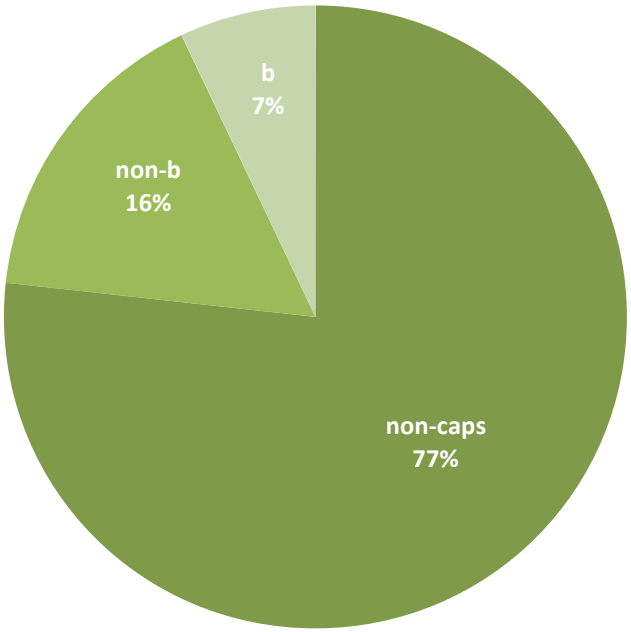
General serotype analysis

Of the 2 152 reported confirmed cases of invasive *H. influenzae* disease, only 1 062 (49.4%) included information on the isolate serotype. Of these, non-capsulated isolates made up 77% of cases (n=815), followed by non-b serotypes (16%, n=172) (Figure 2.7 and Annex 2 Table B13).

Twenty countries reported serotype data. For 12 of these countries non-capsulated strains made up more than 60% of the cases. Among the other countries the number of reported cases with available serotype data was often very low (<10 cases). The Netherlands reported 57.9% of isolates as serotype b (n=22) (Annex 2 Table B13).

Serotype-specific notification rates remained relatively stable between 2008 and 2011. A slight decline was observed in serotype b notification rates while the notification rate for non-caps (non-typeable) strains has increased since 2008 (Figure 2.8, Annex 2 Table B14).

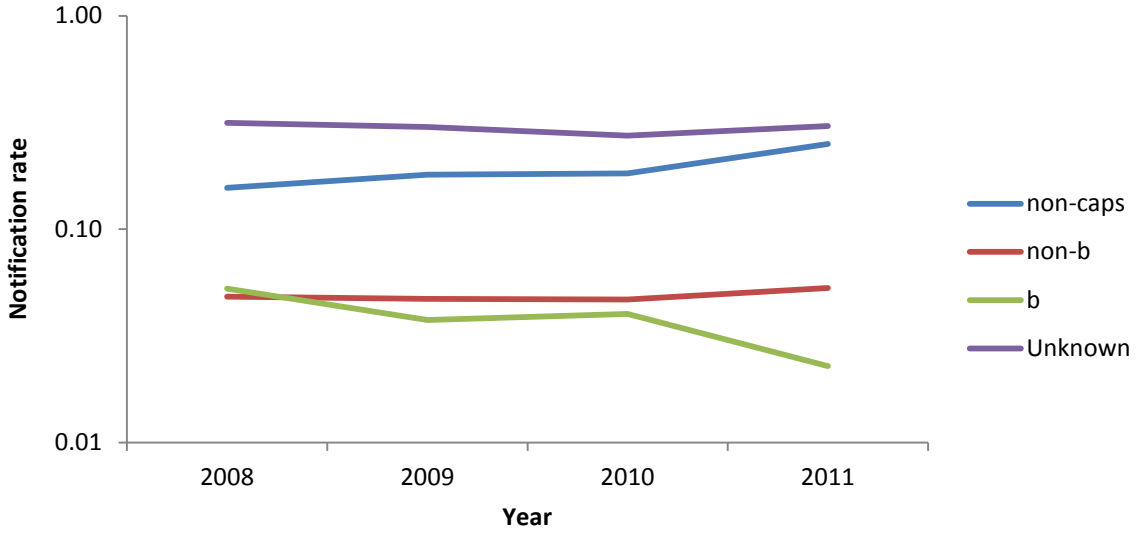
Figure 2.7 Distribution of reported invasive *H. influenzae* cases by serotype, EU/EEA countries, 2011 (n=1 062)



** Non-b includes serotypes A, C, D, E, F and isolates classed as 'non-b'*

[11] http://vaccine-schedule.ecdc.europa.eu/Pages/Scheduler.aspx

Figure 2.8 Notification rates of invasive *H. influenzae* disease in EU and EEA countries, by serotype and year, 2008-11 (n=7 512)

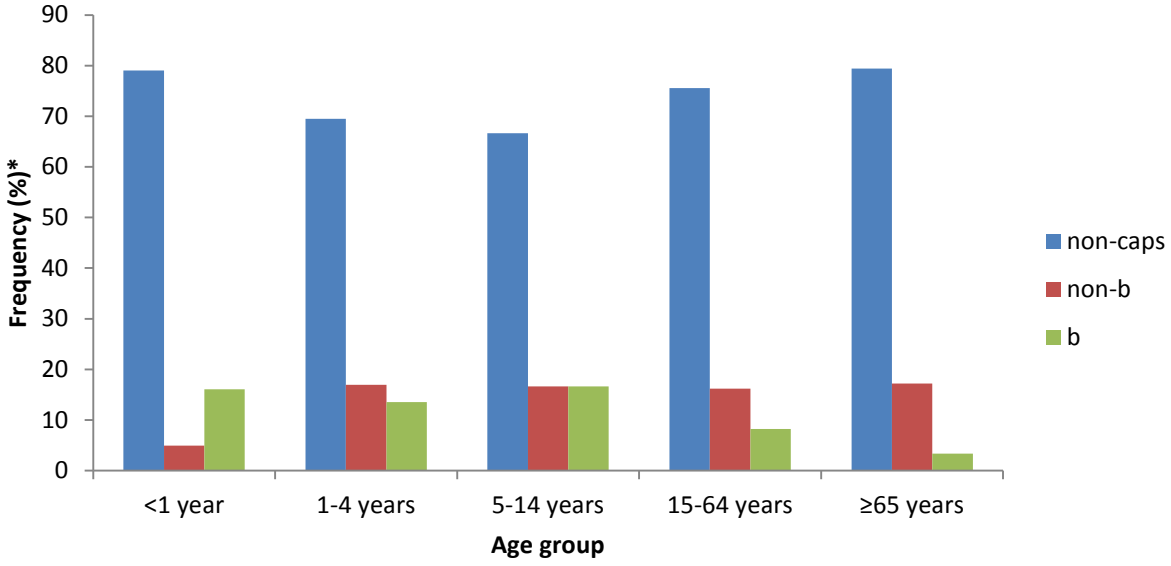


Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom

Serotype by age and gender

Non-capsulated serotype was reported in >60% cases for all age groups. The proportion of serotype b cases by age group was similar across the three age groups aged <15 years, but lower in cases aged ≥15. The proportion of serotype non-b cases was similar across all age groups except those aged <1 year (Figure 2.9, Annex 2 Table B15). Serotype distribution was comparable by gender (Annex 2 Table B16).

Figure 2.9 Distribution of invasive *H. influenzae* serotypes by age group, EU/EEA countries, 2011 (n=1 057)**



** Frequency refers to the proportion of the total cases for which serotype information is available by age group*
*** Overall five missing cases for age group among all serotypes: serotype non-caps (n missing=1), and non-b (n=4)*

Serotype and clinical presentation

Serotype information was available in 81.7% of the reported cases for which clinical presentation was known and not recorded as 'not under surveillance'. Among the cases where serotype information and clinical presentation were known, 71.3% of the clinical presentations were septicaemia (n=409). There was little variation by clinical presentation in the proportion of each serotype isolated (Table HI3).

Table 2.3 Distribution of invasive *H. influenzae* serotypes by clinical presentation, EU/EEA countries, 2011 (n=579*)

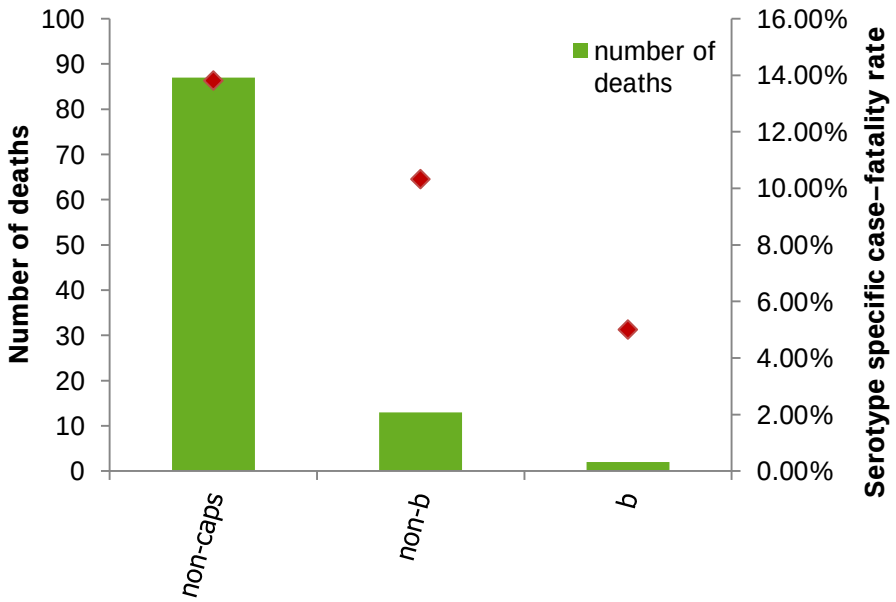
Serotype	Septicaemia		Meningitis		Pneumonia		Other		Meningitis/ septicaemia		Cellulitis		Osteomyelitis/ septic arthritis		Total
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
non-caps	339	82.9	31	57.4	49	73.1	25	67.6	1	33.3	1	50.0	1	50.0	447
non-b**	54	13.2	16	29.6	14	20.9	9	24.3	1	33.3	1	50.0	1	50.0	96
b	16	3.9	7	13.0	4	6.0	3	8.1	1	33.3	0	0.0	0	0.0	31
Total	409		54		67		37		3		2		2		574

** Overall 488 missing or 'not under surveillance' cases for clinical presentation among all serotypes.*
*** Non-b includes serotypes a, c, d, e, f and isolates classed as 'non-b'.*

Serotype and case–fatality

Of 126 reported deaths, 80.9% had serotype data available (n=102). Non-capsulated accounted for the majority of reported deaths (n=87), and had the greatest CFR (13.8%) (Figure 2.10).

Figure 2.10 Distribution of reported invasive *H. influenzae* case deaths (n=796*) and case–fatality rate by serotype, EU/EEA countries, 2011



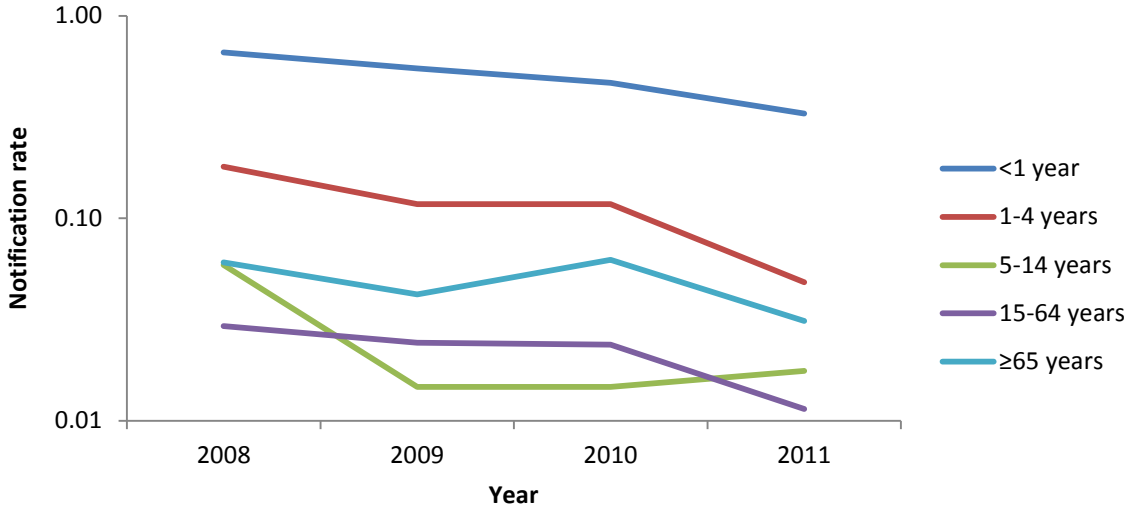
** Total number of cases for which outcome and serotype information was known.*

Serotype b strains

Between 2008 and 2011, cases aged <1 year of age were the age group most affected by invasive *H. influenzae* type b disease, although there was a notable decrease in this age group. Notification rates over this period for the age groups 1–4 years and 15–64 years also declined. (Figure 2.11, Annex 2 Table B17).

The rate of invasive *H. influenzae* serotype b disease among <5 year olds was used as the main indicator of the burden of disease. During the period 2008– 2011 almost all countries reported notification rates <1 per 100 000 population, except for Lithuania (2008), the Netherlands (2009 and 2010) and Estonia (2011). The total number of cases of type B infection in cases aged <5 years more than halved between 2008 and 2011 (Table HI4).

Figure 2.11 Notification rate of invasive *H. influenzae* serotype b disease, by age group and year of reporting, EU/EEA countries, 2008–11 (n=477)



Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom.

Table 2.4 Notification rate and number of reported cases of invasive *H. influenzae* serotype b disease in children <5 years of age, by country and year, EU/EEA countries, 2008-11 (n=149)

Serotype	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
Austria	1	0.3	0	0.0	1	0.3	1	0.3
Czech Republic	1	0.2	1	0.2	0	0.0	0	0.0
Denmark	2	0.6	1	0.3	0	0.0	1	0.3
Estonia	0	0.0	0	0.0	0	0.0	1	1.3
Finland	1	0.3	2	0.7	0	0.0	1	0.3
France	0	0.0	0	0.0	3	0.2	0	0.0
Greece	0	0.0	2	0.3	0	0.0	1	0.2
Hungary	0	0.0	0	0.0	0	0.0	0	0.0
Ireland	3	0.8	1	0.3	0	0.0	0	0.0
Italy	1	0.0	1	0.0	1	0.0	0	0.0
Lithuania	2	1.2	1	0.6	0	0.0	0	0.0
Netherlands	7	0.8	9	1.0	9	1.0	6	0.6
Norway	1	0.3	1	0.3	0	0.0	1	0.3
Poland	7	0.3	7	0.3	7	0.3	2	0.1
Portugal	0	0.0	0	0.0	0	0.0	0	0.0
Romania	2	0.2	0	0.0	3	0.3	1	0.1
Slovakia	0	0.0	1	0.3	1	0.3	0	0.0
Slovenia	0	0.0	0	0.0	0	0.0	0	0.0
Spain	1	0.0	1	0.0	0	0.0	0	0.0
Sweden	0	0.0	1	0.2	5	0.9	1	0.2
United Kingdom	23	0.6	9	0.2	8	0.2	5	0.1
Total	**52**		**38**		**38**		**21**	

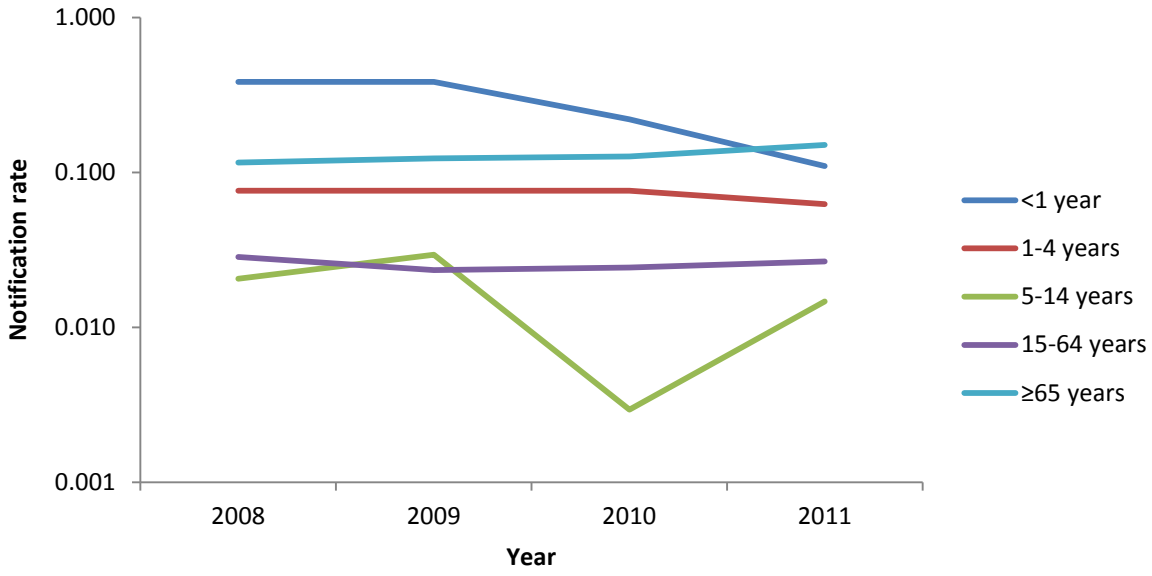
N = Number of cases, NR = Notification rate

Non-type b strains

Notification rates of *H. influenzae* disease due to non-type b strains were highest among cases aged <1 year during the period 2008–2010, however there was a decrease in this age group and for 2011 the highest notification rate was observed in cases aged ≥65 for which there was an increasing trend. Patients aged ≥65 years made up 46.1% of cases (Figure 2.12, Annex 2 Table B18).

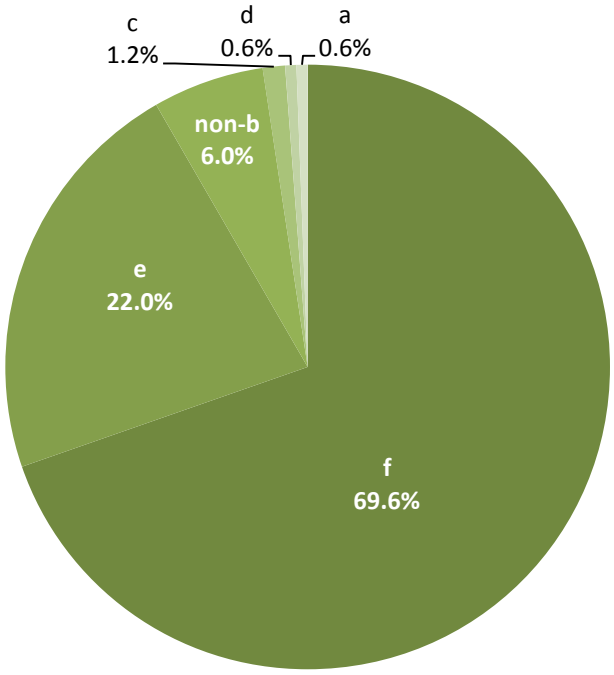
H. influenzae type f was the most common non-b type strain (69.6%), followed by serotype e (22.0%) (Figure 2.13).

Figure 2.12 Notification rate of invasive *H. influenzae* non-b disease, by age group and year of reporting, EU/EEA countries, 2008–11 (n=610)



Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom.

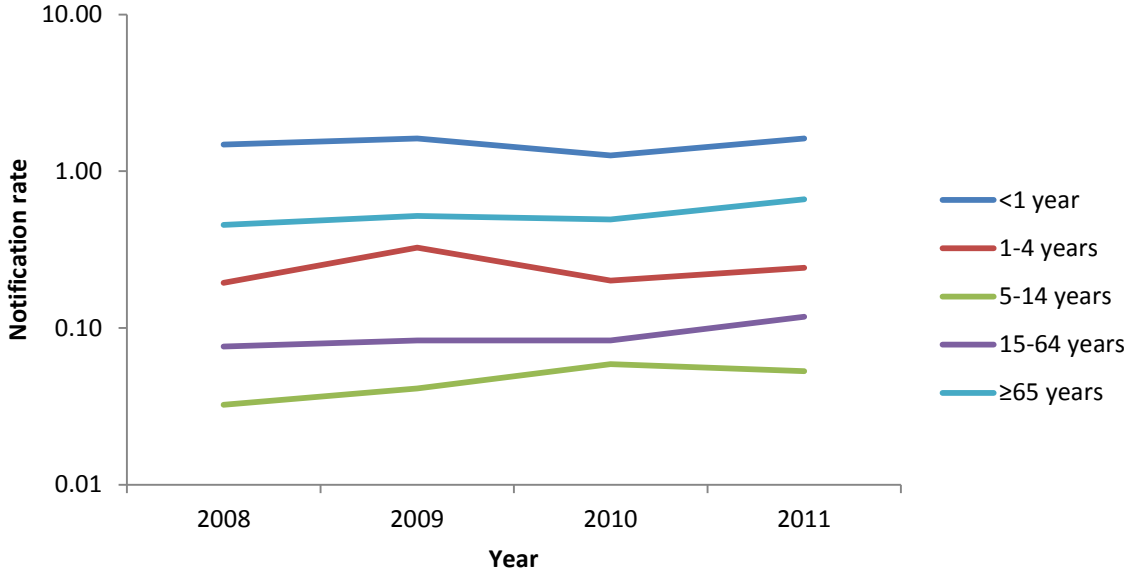
Figure 2.13 Percentage distribution of non-b serotypes of invasive *H. influenzae* disease (n=168), EU/EEA countries, 2011



Non-capsulated strains

Notification rates of *H. influenzae* disease due to non-capsulated strains were highest among cases aged <1 year for 2008 – 2011, with the trend fluctuating during this time. There was a slight increasing trend in cases aged 15 – 64 years. Cases aged ≥65 made up 48.9% of cases (Figure 2.14, Annex 2 Table B19).

Figure 2.14 Notification rate of invasive *H. influenzae* (non-capsulated) disease, by age group and year of reporting, EU/EEA countries, 2008–11 (n=2 368)



Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom.

3. Invasive meningococcal disease (IMD)

3.1 Introduction

Invasive meningococcal disease (IMD) is caused by the bacteria *Neisseria meningitidis*, a common commensal of the upper respiratory tract for which human carriers are the only reservoir. IMD is an acute disease, rare but severe and potentially life-threatening and occurs most frequently in young children, with other peaks in cases often reported in adolescents and young adults and the elderly. It may be characterised by meningitis, meningococcemia, bacteraemia, sepsis, or less commonly pneumonia, arthritis and pericarditis. The case–fatality rate is high with 10–20% of survivors suffering long-term sequelae including mental retardation, hearing loss and loss of limbs [53].

Timely, appropriate antibiotic therapy can usually cure IMD. Vaccines are also available that protect against infection caused by serogroup C IMD, or against serogroups A, C, Y and W135 IMD. Most cases in Europe are caused by serogroups B and C. Since several countries have introduced the vaccine against serogroup C into their immunisation programmes a decrease has been observed in the burden of the disease [54–56]. Recently a vaccine against group B disease was granted a licence from the European Commission and will soon be available for possible inclusion in childhood immunisation programmes[12].

3.2 Main points

- Overall, 3 808 confirmed cases of IMD were reported by 29 EU/EEA countries in 2011.
- The notification rate across Europe was 0.77 cases per 100 000 population, ranging from 1.99 (Ireland) to 0.09 (Latvia). IMD appears to be rare in the majority of Member States.
- There was a clear seasonal distribution of cases, with a noticeable peak of cases in January.
- As in previous years, <1 year olds were most affected (12.3 cases per 100 000), followed by those aged 1–4 years (4.1 per 100 000), although there was a decrease in both of these age groups. Notification rates were lower in older age groups, although a small peak was observed in adolescents and young adults. This trend was seen in most countries.
- In Europe, 73.6% of IMD was caused by serogroup B in 2011 and it was most prominent in infants aged <1 year (10.0 per 100 000) and 1–4 year olds (3.3 per 100 000). In <1 year olds, 88.3% of cases (n=535) were due to serogroup B, although numbers are decreasing in this age group, driven by dwindling case numbers in the UK.
- Serogroup C accounted for 14.4% of cases in 2011. Notification rates were highest in infants aged <1 year (0.92 per 100 000) and 1–4 year olds (0.36 per 100 000). These rates are notably 10-fold lower than in cases of serogroup B infection in the same age groups.
- Notification rates of serogroup C disease were higher in countries without Meningococcal C conjugate (MCC) vaccination across all age groups. This difference was greatest in cases aged 1–4 years (0.2 in cases from countries with MCC, 0.9 in countries without MCC). During the period 2008–2011, in cases aged <5 years a decrease was observed in serogroup C infection in countries with MCC. In countries without MCC vaccination the rate remained stable.
- From 2008 to 2011, the rate of serogroup Y doubled from 0.03 cases per 100 000 to 0.06. In 2011, the highest notification rates were observed in cases aged <1 year (0.21 per 100 000), ≥65 years (0.12) and 15–24 years (0.10). An increase was observed in cases aged <1, 1–4 and 25–49.
- Meningitis was the clinical presentation in 42.6% of cases. There was no relationship observed between a specific clinical presentation and serogroup.
- The overall CFR in EU/EEA countries was 8.7% and was highest in cases aged 65 years or older (17.1%) and in cases of septicaemia (18.5%). The CFR in serogroups B and C were 7.1% and 15.5% respectively.
- The large majority of isolates tested in 2011 were susceptible to the antibiotics currently used for treatment and prophylaxis (rifampicin, cefotaxime/ceftriaxone, penicillin G, and ciprofloxacin).
- Molecular typing showed that the bacterial population was highly diverse, in line with findings in previous years.
- There was a high proportion of missing data for some variables including vaccination status, clinical presentation and antimicrobial resistance. Results that incorporate these variables must be interpreted with caution. Differences in surveillance systems should be considered for all variables.

3.3 Methods: data analysis and quality

3.3.1 Data source

Comprehensive surveillance systems are in place in the majority of the countries that reported confirmed cases in 2011, while sentinel surveillance data is reported by Cyprus and the Netherlands. According to the data source profiles uploaded by the countries, 22 countries had a reconciled notification/laboratory surveillance system

[12] http://www.ema.europa.eu/docs/en_GB/document_library/EPAR_-_Summary_for_the_public/human/002333/WC500137857.pdf

(meaning that laboratory data and epidemiological and/or vaccination information are collected and filed together on a case-by-case basis at national level). Two countries only had laboratory-based surveillance systems and five countries only presented data from a notification system.

3.3.2 Data analysis

Due to the potential overlap of data sources, surveillance system population coverage or age restrictions, the following criteria were applied for specific countries in the analysis of IMD data:

- For Spain, data on IMD were reported by two sources. The data reported by the data source ES-STATUTORY_DISEASES (notification data) were taken into account for the general variables (e.g. age, gender, notification rates) and also data on serogroup, which is more complete in this data source. Data uploaded from the ES-NRL data source (voluntary laboratory data) were taken into account for the analysis of the laboratory variables (e.g. laboratory methodology and antimicrobial resistance). As both data sources were included in the report, data from both sources are taken into account in Annex 3, Table C2.
- Cyprus reported sentinel surveillance data, for which the population coverage was unknown and so data from Cyprus were excluded from the notification rates analysis.
- For the Netherlands, only data reported from the sentinel surveillance source NL-NRBM were included. In previously published IBD reports data from NL-OSIRIS were used.
- Aggregated data were reported by Bulgaria and included where possible.

This report includes the total number of reported confirmed cases of IMD and a description of epidemiological and laboratory variables with appropriate completeness. Statistical analysis was performed using STATA® 12.0 (StataCorp, USA) and data are presented with the 'date used for statistics' as the preferred date. This is the date that the country chooses as its preferred date for reporting and could be date of disease onset, date of diagnosis, date of notification, or any other date the country uses nationally.

Notification rates were calculated by using numbers of cases as the numerator and total population, or surveillance system population coverage, as the denominator. Countries that reported sentinel surveillance included Cyprus and the Netherlands. The Netherlands reported the level of population coverage in their sentinel system and so was included in the notification rates analysis. The level of population coverage in Cyprus was not known and data from Cyprus was not included in the notification rates analysis. For figures or tables where notification rates over time are considered, only countries that reported for all the displayed years were included. In these cases countries are listed below the respective figure/table.

There is no common definition of the point in time at which a fatal outcome is determined. This may add variation to the outcome figures throughout Europe. Acknowledging the differences in IMD surveillance systems and reporting across Europe, CFR was calculated on a country basis. Serogroup-specific case–fatality rate was calculated following the same rule. Consequently only cases with known outcomes were considered. Unless presented, all other 'unknown' and 'missing' responses were excluded from analysis. For clinical presentation, cases with clinical presentation reported as 'Not under surveillance' were excluded.

The vaccination status 'fully vaccinated' and 'partly vaccinated' were defined by the reporting country according to its immunisation schedule.

Member States were asked to provide minimum inhibitory concentration (MIC) according to the standards and protocols used for antimicrobial susceptibility testing at national level. As a reference, EUCAST clinical breakpoints[13] were used to determine resistance.

3.3.3 Data quality

In 2011, 3 808 confirmed cases of IMD were reported by 29 countries, namely Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom. Liechtenstein did not report data on IMD in 2011.

Data on serogroup were reported by 27 countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom.

All cases considered for inclusion in the analysis were laboratory-confirmed cases. All countries reported case-based data except Bulgaria, which submitted aggregated data.

Overall, data on age, age month, gender, classification and serogroup were complete, or almost complete. There was a decrease in the proportion of missing data for all variables between 2010 and 2011, except for 'Outcome' (0.9% increase), 'Serogroup' (0.9% increase) and 'Vaccination Status' (2.5% increase). Data on antimicrobial resistance was largely incomplete. For each of the four antimicrobials presented, more than 60% of data was missing (Annex 3 Table C2).

[13] http://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Breakpoint_tables/Breakpoint_table_v_3.1.xls

3.3.4 Laboratory methods used for strain identification

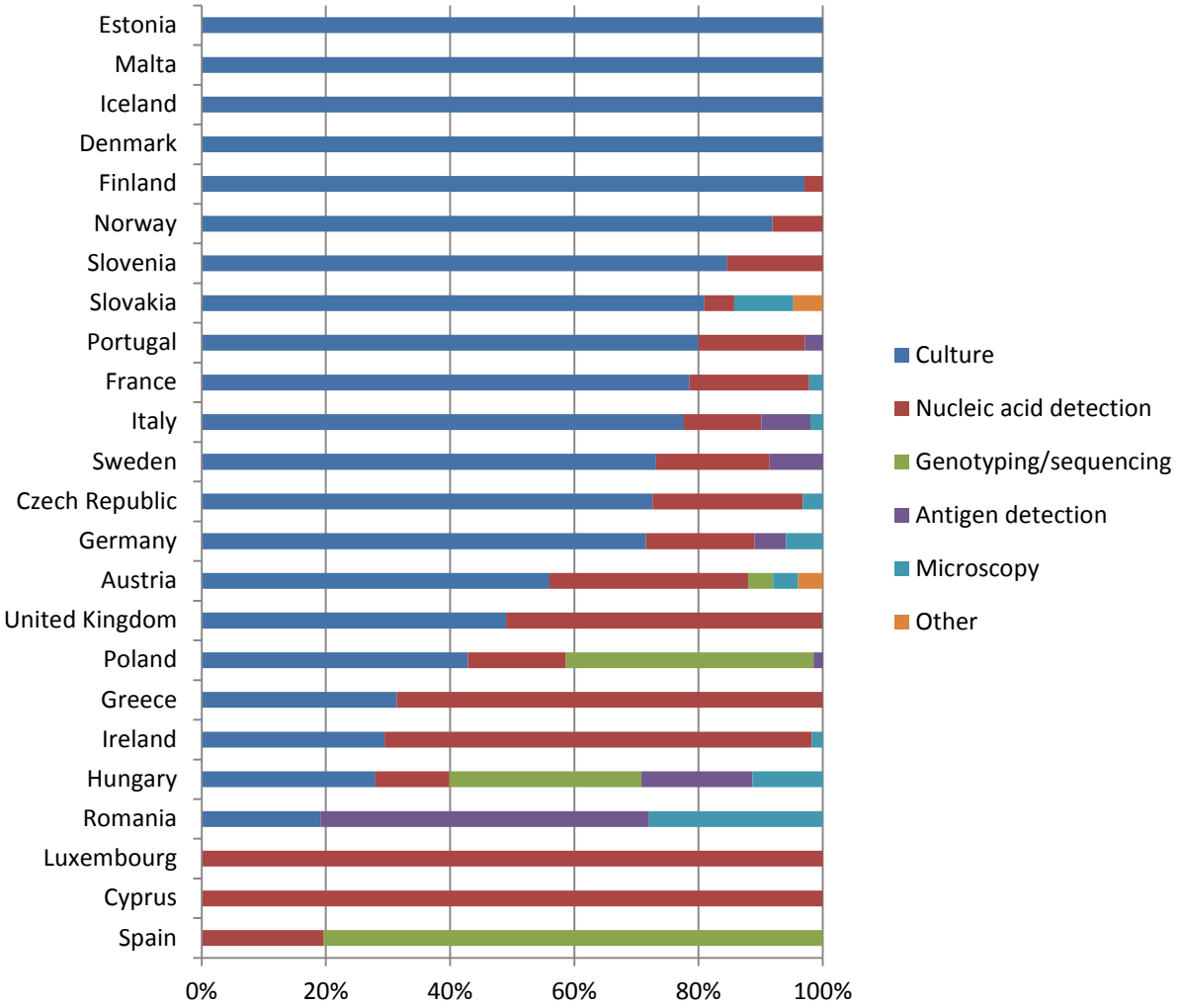
Specimens

Blood isolates accounted for 53.7% (n=1 559) of the 2 905 cases for which the specimen was reported and CSF accounted for 43.7% (n=1 269) (Annex 3 Table C3). The proportions of blood and CSF specimens were comparable in all age groups except those aged ≥65 years (Annex 3, Table C4).

Test method

Information on test method was available for 80.2% of cases from 24 countries. Eighteen countries reported the use of two test methods or more, and 13 reported the use of three test methods or more. Culture was the most frequently reported method, accounting for 53.5% of tests (n=1 931), followed by nucleic acid detection (27.7%, n=1 001). All countries reported the use of at least one of these two methods. Genotyping/sequencing was the predominant method used by Spain (80.4%, n=242) and, of all cases where genotyping/sequencing was the test method, 50.2% (n=242) came from Spain. Antigen detection was the predominant method reported by Romania (52.9%, n=36) (Figure 3.1).

Figure 3.1 Proportion of strain identification methods used on primary specimen of cases reported as IMD by country, in EU/EEA countries, 2011 (n=3 608)



**Only data from ES-NRL for Spain.*

Note – More than one strain identification method may have been used on a single specimen

3.4 Results

3.4.1 Number of cases

In 2011, 3 808 confirmed cases of IMD were reported by 29 EU/EEA countries. The overall reported confirmed case rate was 0.77 per 100 000, ranging from 1.99 (Ireland) to 0.09 (Latvia). High rates were also observed in the United Kingdom (1.66), Malta (1.44), Denmark (1.29) and Lithuania (1.29). Trends were stable across most countries. Notification rates in all countries need to be interpreted and compared cautiously due to the diversity of surveillance systems and variations in the completeness/representativeness of their data (Table NM4).

Table 3.1 Number of reported cases and notification rates (cases per 100 000 population) of IMD cases in EU/EEA countries, 2008–2011

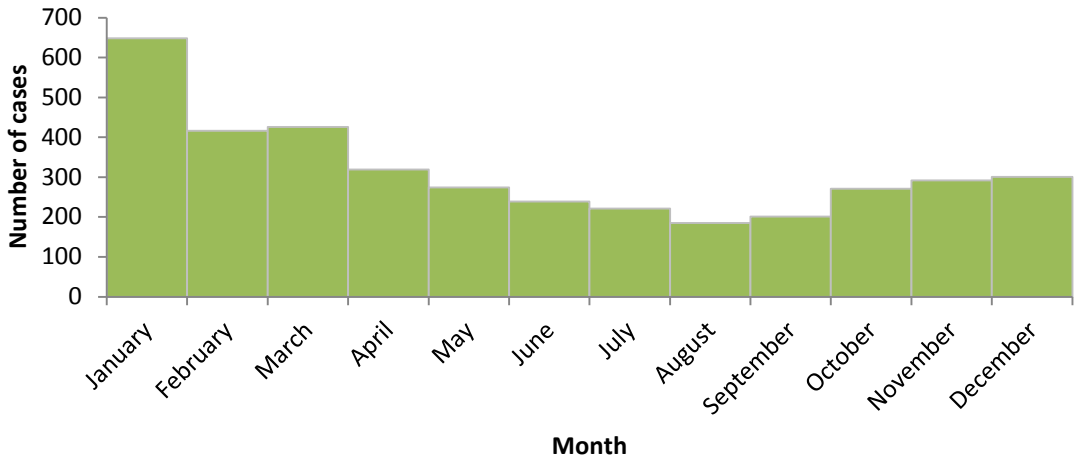
Country	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
Austria	84	1.00	89	1.06	85	1.01	49	0.58
Belgium	110	1.00	104	0.95	96	0.88	111	1.01
Bulgaria*	20	0.27	16	0.21	8	0.11	13	0.17
Cyprus^	2	0.24	1	0.12	1	0.12	1	0.12
Czech Republic	82	0.78	80	0.76	60	0.57	63	0.60
Denmark	63	1.13	71	1.28	66	1.19	72	1.29
Estonia	6	0.45	5	0.37	2	0.15	7	0.52
Finland	28	0.52	33	0.61	34	0.63	34	0.63
France	657	1.01	606	0.93	511	0.79	563	0.87
Germany	451	0.55	493	0.60	384	0.47	363	0.44
Greece	78	0.69	77	0.68	55	0.49	51	0.45
Hungary	30	0.30	37	0.37	37	0.37	67	0.67
Ireland	152	3.39	134	2.99	98	2.19	89	1.99
Italy	178	0.29	181	0.30	150	0.25	152	0.25
Latvia	6	0.27	9	0.40	5	0.22	2	0.09
Lithuania	48	1.48	39	1.20	48	1.48	42	1.29
Luxembourg	2	0.39	3	0.59	1	0.20	2	0.39
Malta	3	0.72	5	1.20	2	0.48	6	1.44
Netherlands#	144	0.86	136	0.82	127	0.76	85	0.51
Poland	321	0.84	301	0.79	228	0.60	282	0.74
Portugal	60	0.56	65	0.61	79	0.74	78	0.73
Romania	104	0.49	102	0.48	52	0.24	68	0.32
Slovakia	48	0.88	39	0.72	37	0.68	21	0.39
Slovenia	24	1.17	15	0.73	9	0.44	13	0.63
Spain	590	1.28	533	1.15	404	0.88	431	0.93
Sweden	49	0.52	65	0.69	67	0.71	68	0.72
United Kingdom~	1355	2.17	1190	1.90	1008	1.61	1036	1.66
EU Total	**4 695**	**0.96**	**4 429**	**0.90**	**3 654**	**0.74**	**3 769**	**0.77**
Iceland	2	0.63	5	1.57	2	0.63	2	0.63
Norway	36	0.73	44	0.89	39	0.79	37	0.75
Total	**4 733**	**0.95**	**4 478**	**0.90**	**3 695**	**0.74**	**3 808**	**0.77**

** Aggregated reporting*
^ Sentinel surveillance, population coverage unknown so notification rate not included.
 # Sentinel surveillance, population coverage known.
~ There is no single surveillance system in the UK. Data are representative (as submitted by England and Wales, Scotland and Northern Ireland), however surveillance systems might not be identical.

3.4.2 Seasonality

The seasonal distribution of IMD cases follows a pattern similar to that of other respiratory diseases. In 2011, the highest rates were observed during the winter months and these decreased during the summer, as was case in in previous years (Figure 3.2). Seasonality by country is presented in Annex 3, Table C5.

Figure 3.2 Distribution of reported IMD cases by month, in EU/EEA countries, 2011 (n=3 793*)



** Number of cases by month was not reported by Luxembourg (two cases). For Bulgaria (13 cases), since the data was aggregated, the number of cases by month could not be determined for confirmed cases only.*

3.4.3 Age and gender

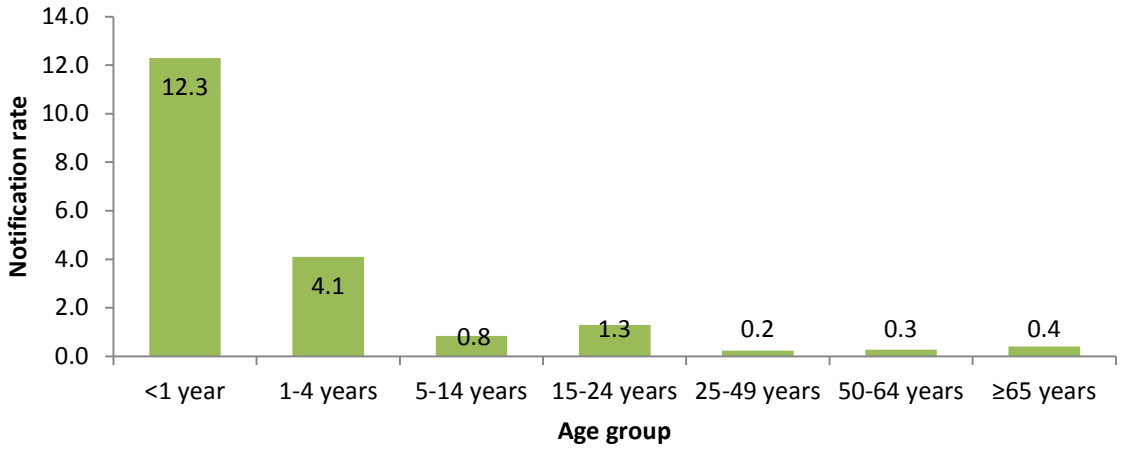
The 3 775 reported cases for which age information was provided (excluding aggregated data) were spread across all age groups, with the highest proportions reported in children aged 1–4 years (23.2%, n=876) and cases aged 15–24 years (20.3%, n=768). A lower proportion of cases was observed in the elderly age groups (Annex 3, Table C6).

The highest notification rates were reported among children aged <1 (12.3 per 100 000) and 1–4 years (4.1 per 100 000) (Figure 3.3). From 2008–2011 there has been a decrease in cases <1 year of age and also to a certain extent in cases aged 1–4 years. The notification rate among adolescents and young adults was consistently the third highest observed (Figure 3.4, Annex 3, Table C7).

Of the 3 800 reported cases where gender information was specified, 51.8% (n=1 969) were male and 48.2% (n=1 831) were female, corresponding to a male/female ratio of almost 1:1.

Regarding the distribution of notification rates between genders, male predominance was more evident in children under one year. Males showed higher rates than females in all age groups ≤24 years of age (Figure 3.5, Annex 3, Table C8).

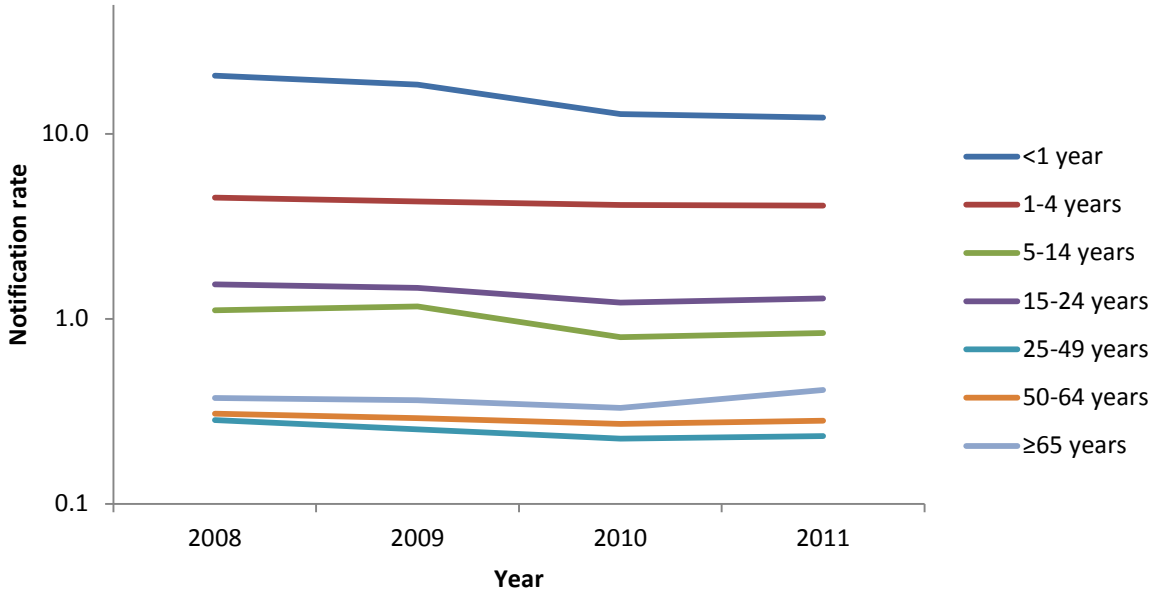
Figure 3.3 Notification rate of reported IMD cases by age group, EU/EEA countries, 2011 (n=3 775*)



Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom

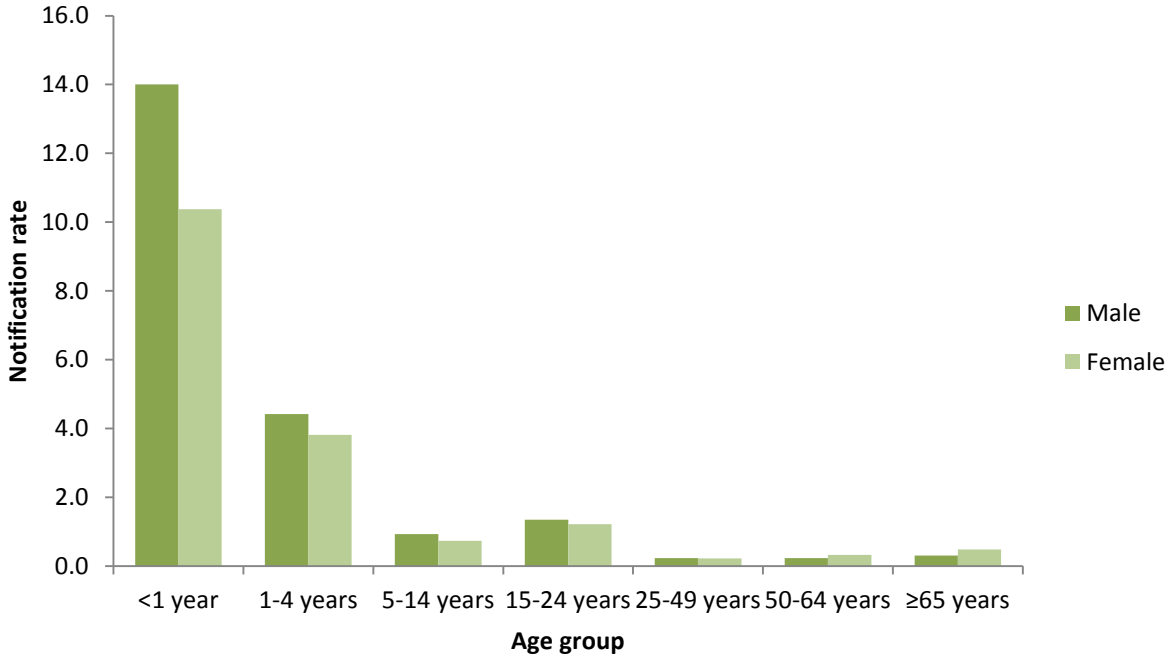
** Excludes aggregated data where different age groups were reported.*

Figure 3.4 Notification rate of reported IMD cases by age group, EU/EEA countries, 2008–2011 (n=16 551)



Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Figure 3.5 Notification rate of reported IMD cases by age group and gender, EU/EEA countries, 2011 (n=3 769*)



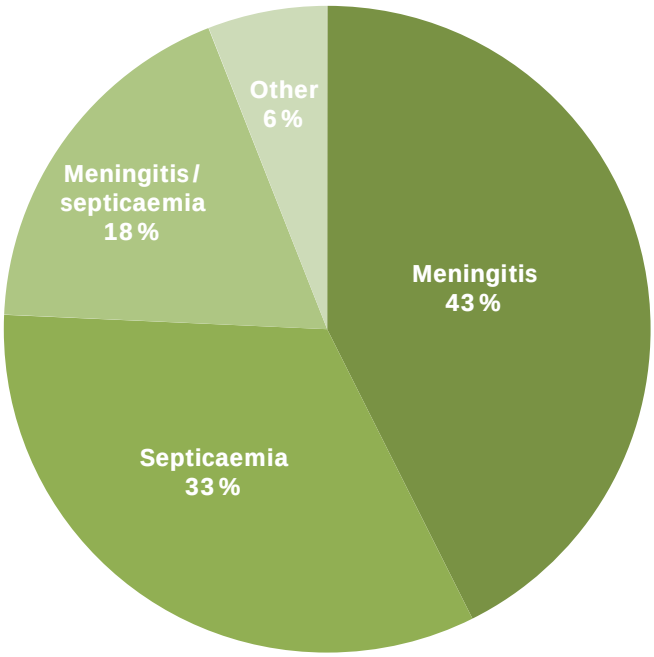
** Excludes 16 unknowns, data from Cyprus for which rates of population coverage were unknown, and aggregated data where different age groups were reported.*

3.4.4 Clinical presentation

Of the 1 824 cases for which the clinical presentation was known (49.1% missing or recorded as not under surveillance), meningitis was the most frequent clinical presentation, accounting for 43% of all cases, followed by septicaemia (33%) (Figure 3.6). At least one case of meningitis was reported by each country reporting on clinical presentation. Only three countries did not report a case with septicaemia and each of those countries reported ≤2 cases (Annex 3 Table C9).

Meningitis was the most common clinical presentation in all age groups except those aged 1–4 years or ≥65 years, for which septicaemia was the most frequent (Table NM2). Data on clinical presentation can be biased by the type of surveillance system in place.

Figure 3.6 Distribution of reported IMD cases by clinical presentation, 2011 (n=1 824



** Excludes cases reported as NUS (Not Under Surveillance).*

Table 3.2 Distribution of reported IMD cases by clinical presentation and age group, EU/EEA countries, 2011 (n=1 815)

Age Group	Septicaemia		Meningitis		Meningitis/ septicaemia		Other		Total
	N	%	N	%	N	%	N	%	N
< 1 year	98	31.7	129	41.7	65	21.0	17	5.5	309
1-4 years	155	38.9	141	35.4	84	21.1	18	4.5	398
5-14 years	84	35.3	95	39.9	50	21.0	9	3.8	238
15-24 years	89	24.3	182	49.7	72	19.7	23	6.3	366
25-49 years	72	33.2	107	49.3	23	10.6	15	6.9	217
50-64 years	35	27.3	68	53.1	16	12.5	9	7.0	128
≥65 years	67	42.1	54	34.0	20	12.6	18	11.3	159
Total	**600**	**33.1**	**776**	**42.8**	**330**	**18.2**	**109**	**6.0**	**1 815**

3.4.5 Case–fatality rate

Twenty-four countries reported data on outcome but the completeness for this variable differed widely from country to country. The overall CFR in EU/EEA countries was 8.7% (n=3 392). Among countries that reported on more than 10 cases, Slovakia had the highest CFR (40.0%, n=20), followed by Hungary (17.9%, n=67). The highest CFR was observed in Luxembourg (50.0%), although the number of cases reported was very low (n=2). Deaths were reported from 20 countries (Annex 3, Table C10) and CFR was highest among cases whose clinical presentation was septicaemia (18.5%) (Annex 3, Table C11). Age-specific CFR were highest among cases aged over 65 years (17.1%). Of all 292 reported deaths, 65 (22.2%) occurred in cases aged 15–24 years (Annex 3, Table C12).

Data on CFR should be interpreted with caution because there is no common approach to the follow-up time for outcome in Europe.

3.4.6 Vaccination status

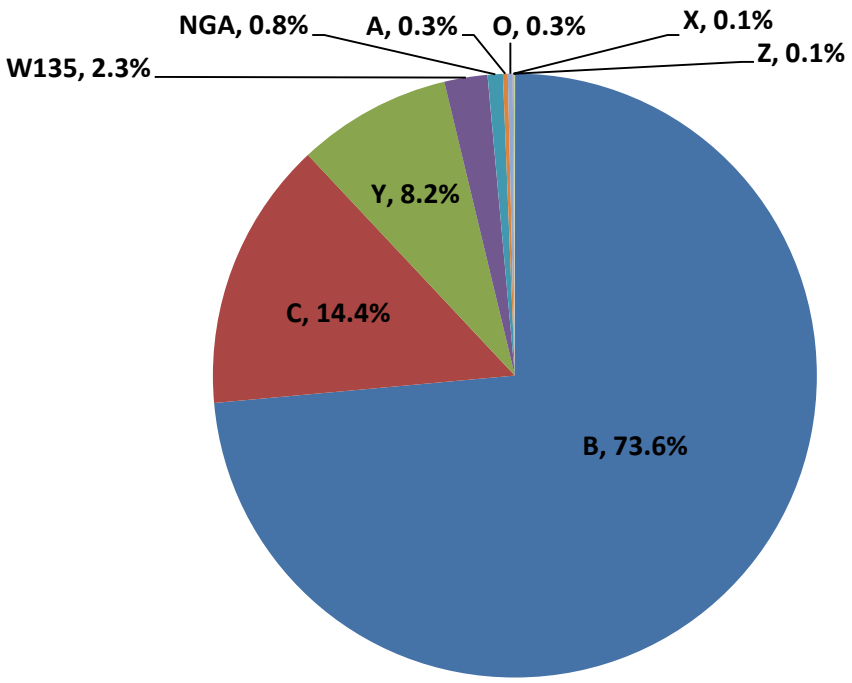
Among European countries where meningococcal vaccination is part of the routine immunisation schedule, meningococcal serogroup C conjugate vaccine is used[14]. Vaccination status was only known in 45.5% (n=228) of all cases of serotype C IMD. Of these cases, 4.9% (n=11) were fully vaccinated, 0.4% (n=1) partially vaccinated and 94.7% (n=216) unvaccinated according to the respective national schedules. The completeness of this variable needs to be improved for more accurate conclusions to be drawn.

3.4.7 Serogroups

General serogroup analysis

Serogroup B made up 73.6% (n=2 551) of IMD cases for which serogroup information was known, followed by serogroup C (14.4%, n=501) (Figure 3.7). Both were observed across a range of EU/EEA countries. The highest proportions of Y cases by country were reported in Norway (54.1%, n=20), Malta (50.0%, n=3) and Sweden (47.0%, n=32) (Annex 3, Table C13). From 2008–2011 there was a slight decreasing trend in the notification rate of serogroup B and C infections and an increasing trend in serogroup Y (Figure 3.8, Annex 3 Table C14). Serogroup A activity remains low (Figure 3.8, Annex 3, Table C14).

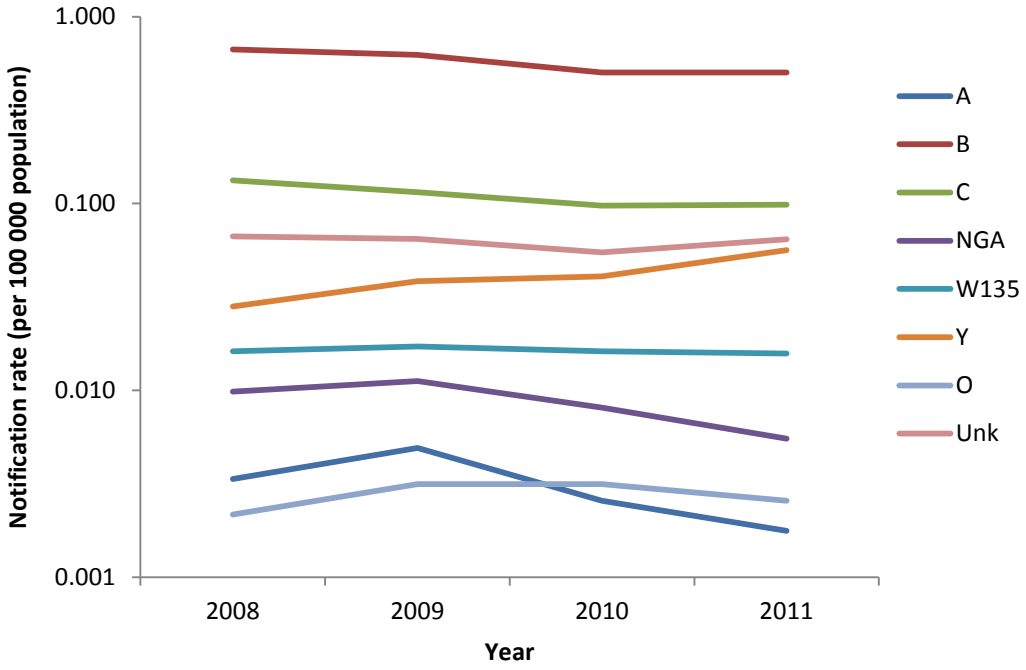
Figure 3.7 Percentage distribution of IMD by serogroup, EU/EEA, 2011 (n=3 468)



NGA = non groupable, O = other. The specific codes are kept for the most common serogroups. Others are the remaining/other groupable serogroups that should be reported.

[14] http://vaccine-schedule.ecdc.europa.eu/Pages/Scheduler.aspx

Figure 3.8 Notification rates of IMD cases, by serogroup, EU/EEA countries, 2008–11 (n=16 651)



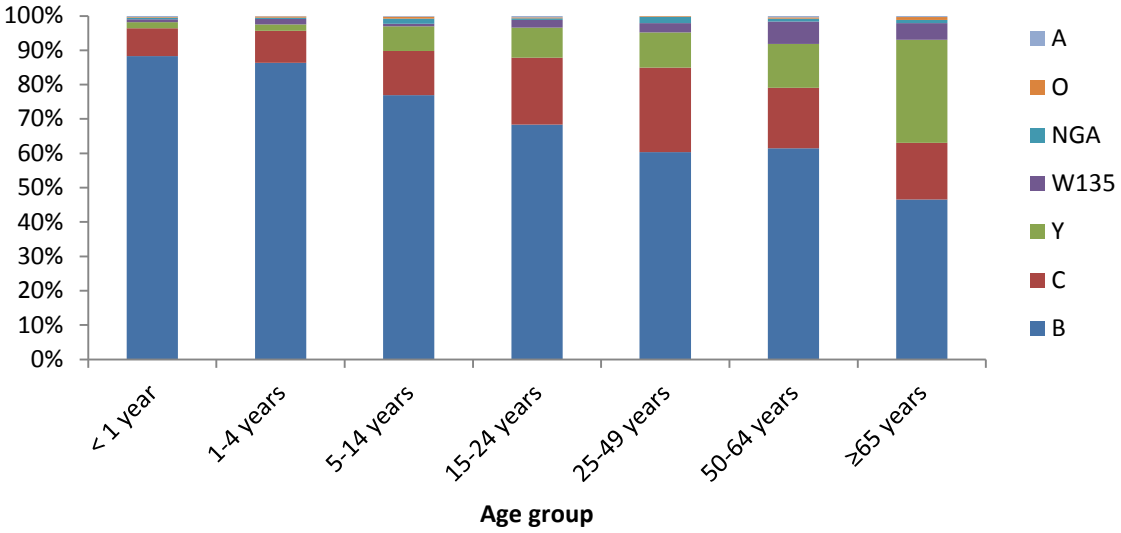
NGA = non groupable, O = other, Unk = unknown. The specific codes are kept for the most common serogroups. Others are the remaining/other groupable serogroups that should be reported.

Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Serogroup and age, gender

The proportion of cases of serogroup B infection went down as age increased, while the proportion of Y serogroup cases was higher in the older age groups. In infants under one year of age, 88.3% of cases (n=535) were due to serogroup B and 8.1% (n=49) to serogroup C. In children aged 1–4 years, 86.4% (n=696) of cases were due to serogroup B, and 9.3% (n=75) to serogroup C. Among serogroup C cases, 27.1% were aged 15–24 years (Figure 3.9). Serogroup distribution was comparable by gender (Annex 3, Table C15).

Figure 3.9 Percentage distribution of IMD by serogroup and age group, EU/EEA, 2011 (n=3 457)



NGA = non groupable, O = other. The specific codes are kept for the most common serogroups. Others are the remaining/other groupable serogroups that should be reported.

Serogroup and clinical presentation

The proportion of each different clinical presentation among serogroup B cases was comparable with the proportion of each different clinical presentation among serogroup C and Y. In all three of these serogroups meningitis was the most common clinical presentation reported (Table NM3).

Table 3.3 Distribution of invasive IMD serogroups by clinical presentation, EU/EEA countries, 2011 (n=1 581*)

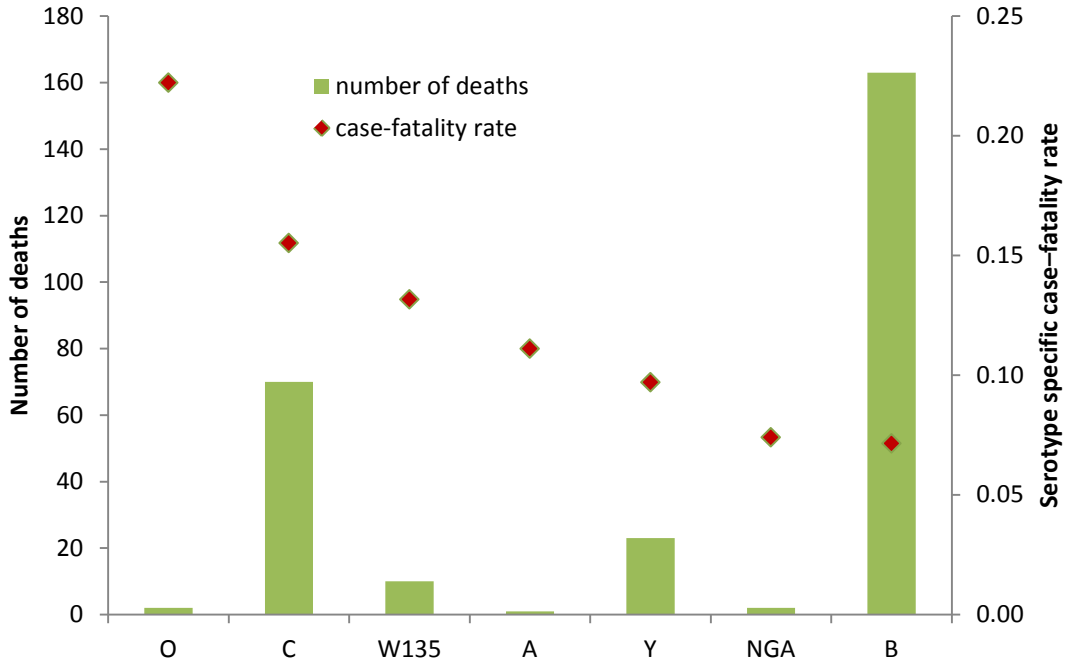
T	Septicaemia		Meningitis		Meningitis/ septicaemia		Other		Total
	N	%	N	%	N	%	N	%	N
A	2	28.6	5	71.4	0	0.0	0	0.0	7
B	379	34.5	464	42.3	209	19.0	46	4.2	1098
C	109	31.9	134	39.2	76	22.2	23	6.7	342
NGA	10	41.7	7	29.2	5	20.8	2	8.3	24
W135	12	50.0	4	16.7	2	8.3	6	25.0	24
Y	27	33.8	35	43.8	9	11.3	9	11.3	80
O	2	33.3	2	33.3	0	0.0	2	33.3	6
Total	541		651		301		88		

** Overall 1 874 missing or 'not under surveillance' cases for clinical presentation among all serogroups.*
*** Total number of cases for which serogroup information is available by clinical presentation.*
NGA = non groupable, O = other. The specific codes are kept for the most common serogroups. Others are the remaining/other groupable serogroups that should be reported.

Serogroup and case–fatality

The highest CFR was found in cases with serogroup reported as other (22.2%) although outcome data was only reported for nine 'other' serogroup cases. The CFR among cases with serogroup C IMD was twice as high as for serogroup B, although this observation should be interpreted with caution as in Europe there is no common approach to the follow-up time or end-point for a fatal outcome (Figure 3.10).

Figure 3.10 Distribution of reported IMD case deaths (n=3 090*) and case–fatality rate by serogroup, EU/EEA countries, 2011



** N refers to the total number of cases for which outcome and serogroup information was known.*

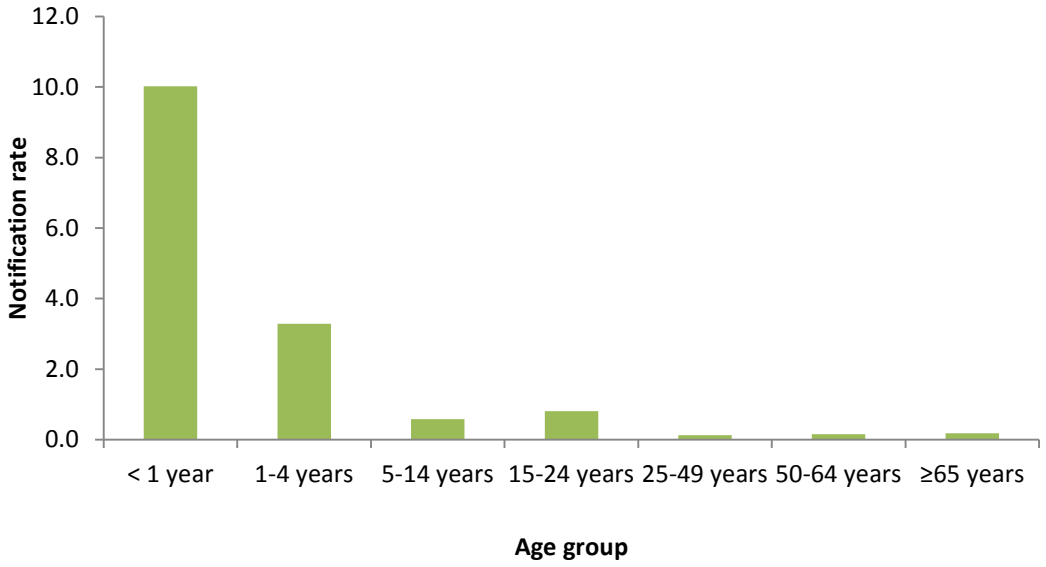
NGA = non groupable, O = other. The specific codes are kept for the most common serogroups. Others are the remaining/other groupable serogroups that should be reported.

Serogroup B

The highest notification rate for serogroup B IMD in 2011 was observed in cases aged <1 year (10.0 per 100 000), followed by cases aged 1–4 years (3.3). Notification rates were lower in older age groups, although a small peak was observed in adolescents and young adults (Figure 3.11, Annex 3, Table C16). Notification rates for cases aged <1 year were highest in Ireland (38.6 per 100 000), the United Kingdom (25.3) and Portugal (17.8). Ireland (9.0) and the United Kingdom (8.6) also presented high rates among cases aged 1–4 years (Annex 3, Table C17).

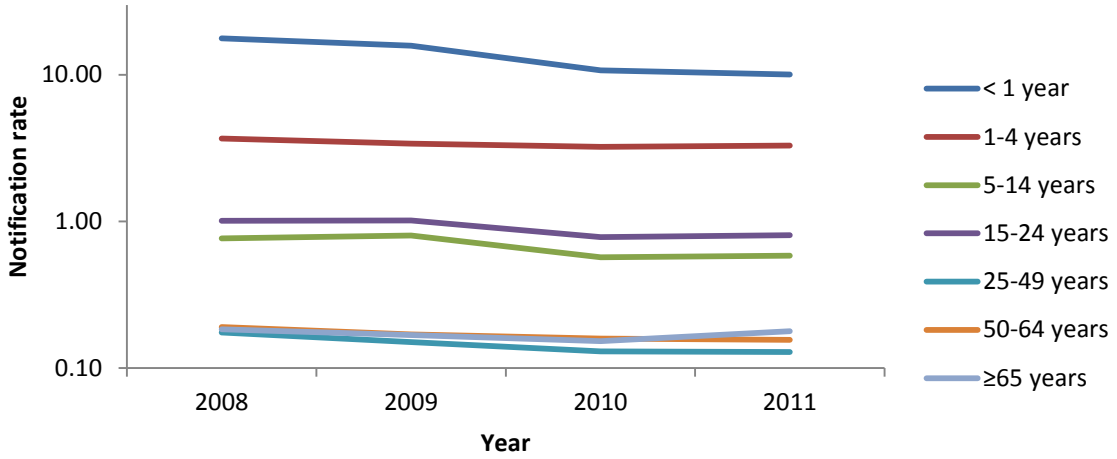
The notification rate of serogroup B cases by age group over time did not show any tendency towards an increase in any age group. There was a notable decrease among children under one year of age (Figure 3.12, Annex 3 Table C18). This trend was driven by the UK, where the notification rate for cases aged <1 year has decreased from 61.5 and 54.3 in 2008 and 2009 to 30.7 and 25.3 in 2010 and 2011. Among cases aged 1–4 years significant decreasing trends were observed in Ireland (notification rate 2008–2011; 19.1, 12.1, 11.7, 9.0), the Netherlands (10.6, 10.8, 7.7, 6.1) and Portugal (5.6, 5.1, 2.9, 2.7).

Figure 3.11 Notification rates of serogroup B IMD cases, by age group, EU/EEA countries, 2011 (n=2 542)



Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Figure 3.12 Notification rate of serogroup B IMD by year and age group, EU/EEA countries, 2008–2011 (n=11 584)



Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Serogroup C

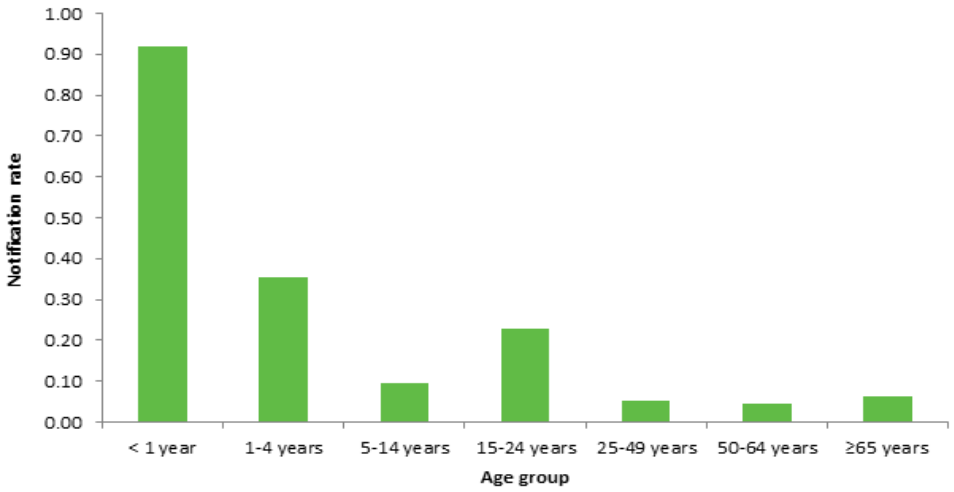
There was an overall decrease in the number of serogroup C infections from 2008–2011 (Figure 3.8). Notification rates were highest in infants aged <1 year (0.92 per 100 000) and 1–4 year olds (0.36 per 100 000). These rates are notably 10-fold lower than in cases of serogroup B infection in the same age groups. Notification rates were lower in older age groups, although a small peak was observed in adolescents and young adults (Figure 3.13, Annex 3, Table C16).

Notification rates for cases aged <1 year were highest in Slovakia (8.9 per 100 000), Denmark (6.3), Poland (4.8) and Hungary (4.5). Denmark (3.4), Poland (3.0) and Lithuania (2.3) were the only countries to report notification rates >1 per 100 000 among cases aged 1–4 years (Annex 3, Table C19).

Notification rates of serogroup C disease were higher across all age groups in countries without Meningococcal C conjugate (MCC) vaccination. This difference was greatest in cases aged 1–4 years (0.2 in cases from countries with MCC, 0.9 in countries without MCC) (Figure 3.14, Annex 3 Table C20).

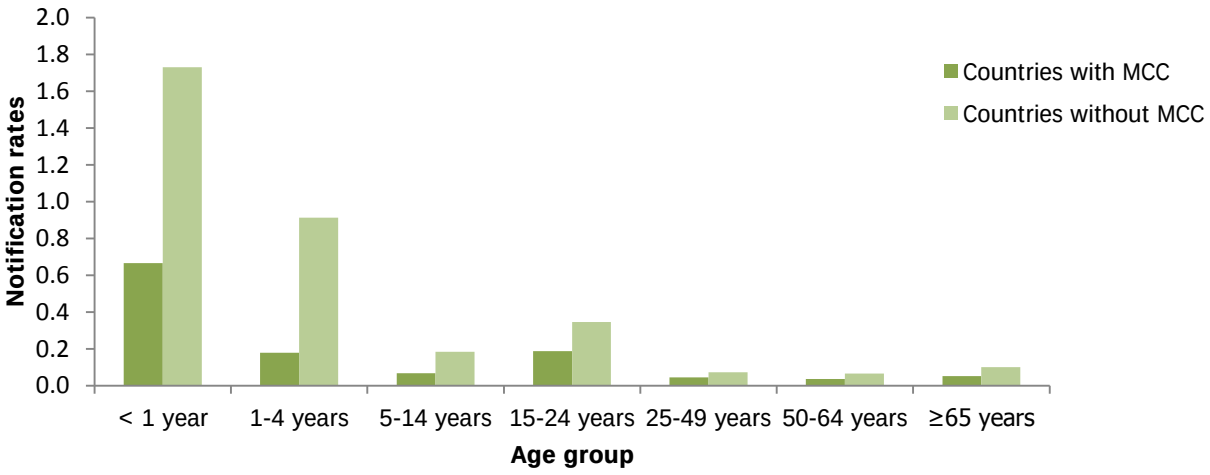
From 2008–2011 no consistent trend was observed in any age group (Figure 3.15, Annex 3 Table C21), however, in cases aged <5 years a decrease was observed in serogroup C infection in countries with MCC. A stable trend was observed in countries without MCC vaccination (Figure 3.16, Annex 3, Table C22).

Figure 3.13 Notification rates of serogroup C IMD cases, by age group, EU/EEA countries, 2011 (n=501)



Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

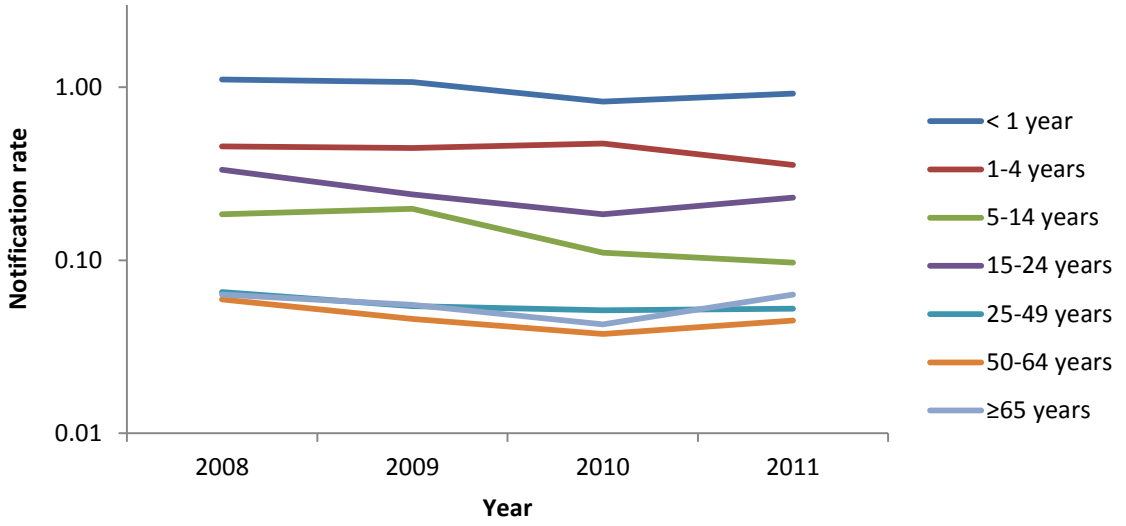
Figure 3.14 Notification rates of serogroup C IMD cases in countries with/without Meningococcal C conjugate vaccination in their routine immunisation schedule, by age group, EU/EEA countries, 2011 (n=501)



Contributing countries with MCC: Austria, Belgium, France, Germany, Greece, Iceland, Ireland, Italy, Netherlands, Portugal, Spain, United Kingdom.

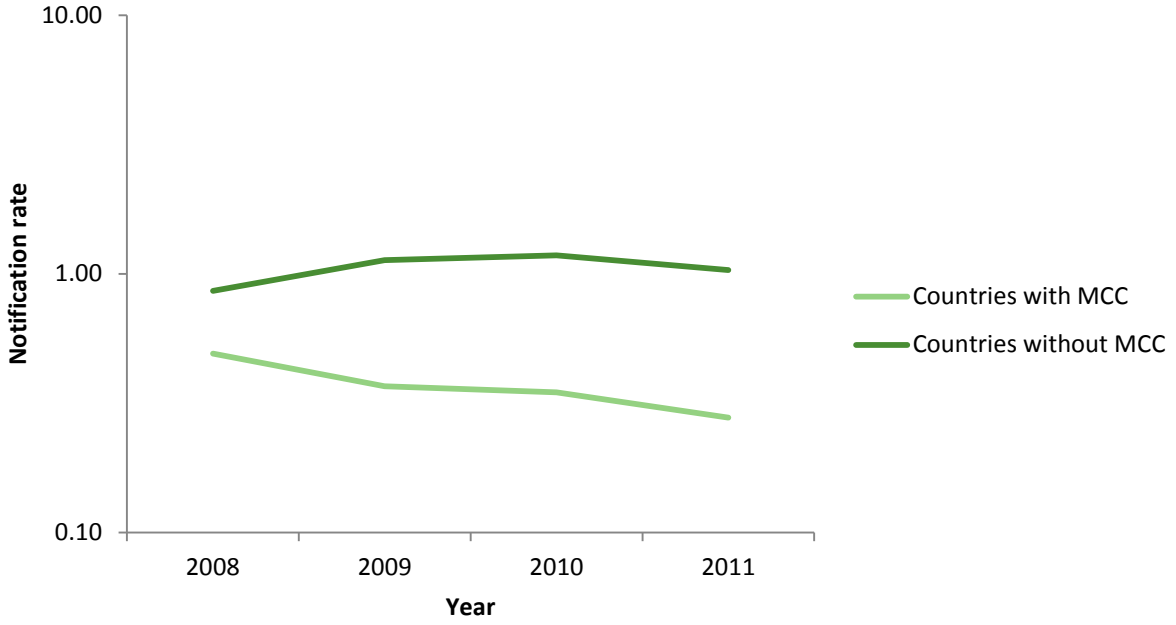
Contributing countries without MCC: Czech Republic, Denmark, Estonia, Finland, Hungary, Lithuania, Malta, Norway, Poland, Romania, Slovakia, Slovenia, Sweden.

Figure 3.15 Notification rate of serogroup C IMD by year and age group, EU/EEA countries, 2008–11 (n=2 233)



Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Figure 3.16 Notification rates of serogroup C IMD in cases aged <5 years in countries with and without Meningococcal C conjugate vaccination in their routine immunisation schedule, EU/EEA countries, 2008–2011 (n=563)



Contributing countries with MCC: Austria, Belgium, France, Germany, Greece, Iceland, Ireland, Italy, Netherlands, Portugal, Spain, United Kingdom.

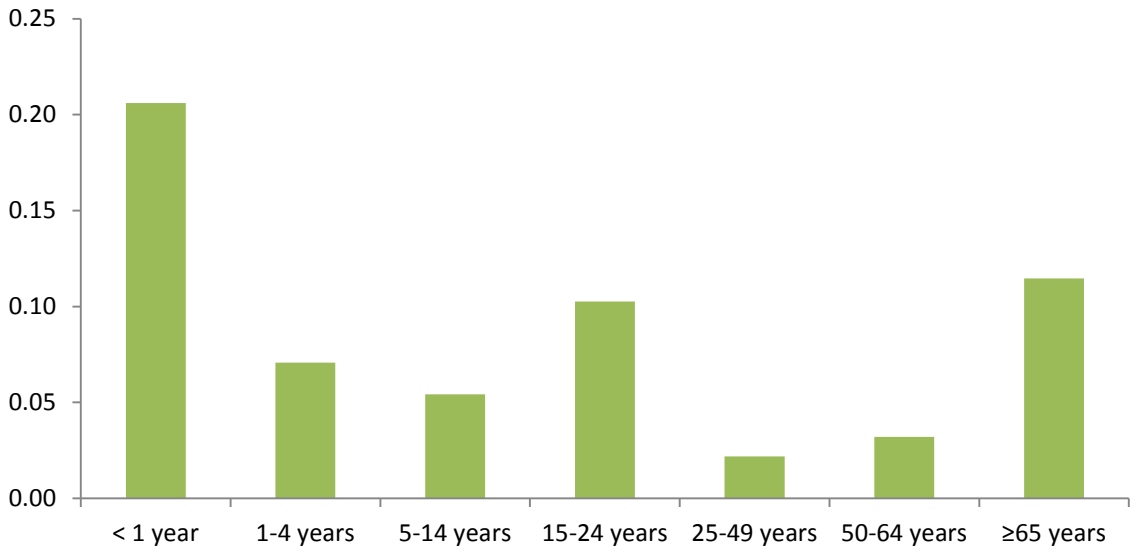
Contributing countries without MCC: Czech Republic, Denmark, Estonia, Finland, Hungary, Lithuania, Norway, Poland, Romania, Slovakia, Slovenia, Sweden.

Serogroup Y

Serogroup Y was the only serogroup for which there was an increase during the period 2008–2011 (Figure 3.8). The highest notification rate for serogroup Y IMD in 2011 was observed in cases aged <1 year (0.21 per 100 000), followed by cases aged ≥65 years (0.12) and 15–24 years (0.10) (Figure 3.17, Annex 3, Table C16). Notification rates for cases aged <1 year were highest in Austria (1.28 per 100 000), Poland (0.99) and the United Kingdom (0.62) (Annex 3, Table C23).

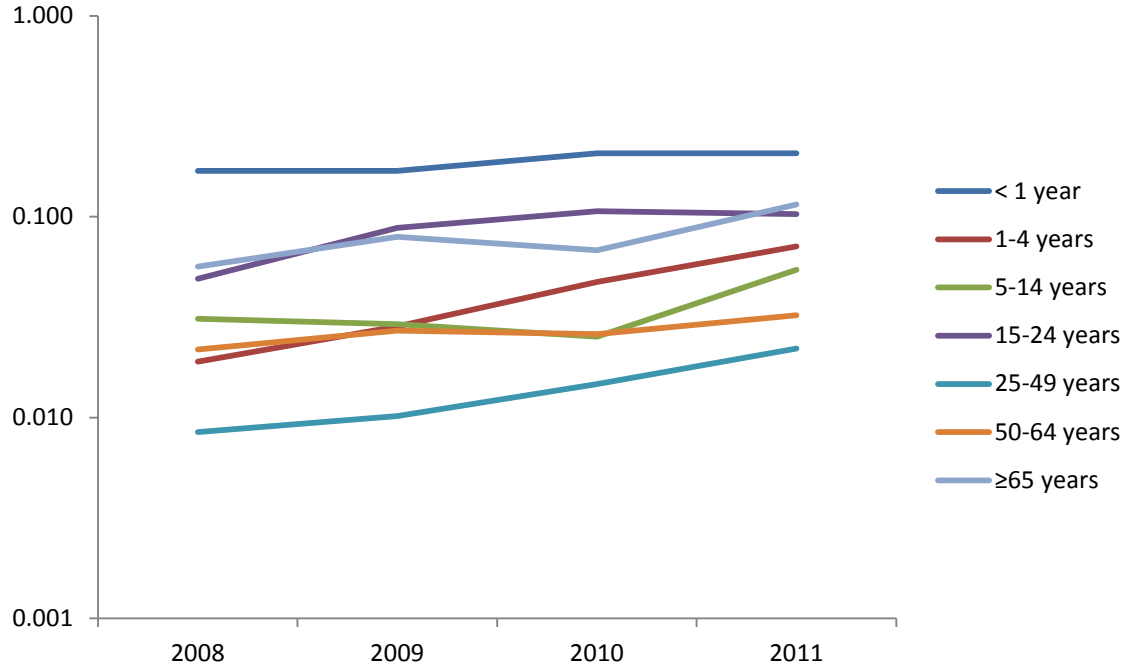
Concerning the notification rate of serogroup Y cases by age group overtime, an increasing trend was observed in cases aged <1, 1–4 and 25–49 years. In other age groups the trends were inconsistent (Figure 3.18, Annex 3, Table C24).

Figure 3.17 Notification rates of serogroup C IMD cases, by age group, EU/EEA countries, 2011 (n=285)



Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Figure 3.18 Notification rate of serogroup Y IMD by year and age group, EU/EEA countries, 2008–2011 (n=830)



Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

3.4.8 Further characteristics of *N. meningitides*

In 2011, 74 FetVR variants in 1 287 cases were reported. Isolates of the variants F3-3 and F1-5 were the most frequently reported (Annex 3, Table C25).

With regard to MLST of *N. meningitides*, the bacterial population was highly diverse, in line with findings in previous years. There were 27 different clonal complexes (CC): 21.0% of isolates belonged to CC ST-41/44, followed by ST-32 (18.6%) and ST-11 (15.3%) (Annex 3, Table C26).

ST-41/44 complex strains were responsible for 31.7% of serogroup B cases, while ST-11 complex strains were reported in 59.4% of cases with serogroup C disease. For 83.2% of serogroup Y cases, ST-23 strains were responsible while 61.9% of serogroup W135 cases were due to ST-22 (Annex 3, Table C27).

A total of 43 PorA1 variants were reported in 2011. The most frequently reported PorA1 variants were 7-2, 22 and 5-1 (Annex 3, Table C28). A total of 94 PorA2 variants were reported in 2011, with the most prevalent being 4, 16 and 2 (Annex 3 Table C29).

3.4.9 Probable country of infection

In 2011, six cases with known probable country of infection were reported as acquired outside the EU: one case in Albania (unknown serogroup), one in China (serogroup Y), one in Iraq (serogroup B), one in Russia, (serogroup W135) and two in Turkey (one serogroup C and one serogroup Y).

3.4.10 Antimicrobial resistance

The large majority of isolates tested in 2011 were susceptible to the antibiotics currently used for treatment and prophylaxis (ciprofloxacin, rifampicin, penicillin G and cefotaxime/ceftriaxone). In total, 681 isolates were tested for resistance to ciprofloxacin, 1 036 to rifampicin, 1 266 to penicillin G and 1 036 to cefotaxime/ceftriaxone. Six strains from Malta and Lithuania were reported as resistant to ciprofloxacin, 12 strains from five countries as resistant to rifampicin, 32 strains from eight countries as resistant to penicillin, and six strains from Lithuania and the United Kingdom as resistant to cefotaxime/ceftriaxone.

4. Discussion

ECDC has published an enhanced surveillance report on invasive *H. influenzae* disease and IMD surveillance in Europe for every year since 2007 (2008 and 2009 data published together). This is the second year of reporting on invasive pneumococcal disease (IPD) and the first report in which data on all three diseases have been published together. Despite the limitations of the data, the analysis reveals some interesting epidemiological points with an important public health perspective.

Invasive pneumococcal disease

In 2011, 20 843 confirmed cases of invasive pneumococcal disease were reported in Europe, with an overall notification rate of 5.59 cases per 100 000 population. The highest notification rates were among adults aged 65 years and over (14.2 per 100 000) and children under one year of age (11.7 per 100 000). This pattern, which has been seen in European data since 2006 as well as in other parts of the world [10–15], supports the recommendations for targeting these age groups for vaccination. Pneumococcal vaccination is currently carried out in 29 EU/EEA countries and is part of routine vaccination in 23 countries (VENICE II[15] [16]). Slovenia, where PCV is not part of the routine immunisation schedule, reported the highest proportion of cases aged 1-4 years (18.4%).

As in 2010, the most prevalent serotypes reported were 7F, 19A, 3 and 1. Children under 15 years were most affected by serotypes 7F, 19A and 1. Serotype 3 was more common in older age groups but is also prominent among younger cases. None of these serotypes are covered by PCV7 although they are included in PCV13. When taking all age groups into consideration, 13.5% (n=2 064) of all cases with reported serotype (n=15 310) would have been covered by PCV7, 33.6% (n=5 149) would have been covered by PCV10 and 54.5% (n=8 340) would have been covered by PCV13. The six additional serotypes included in PCV13 (1, 5, 7F, 3, 6A and 19A) would have covered 41.0% (n=6 276) of all cases with reported serotype. Moreover, compared to 2010, a lower proportion of cases in all age groups were caused by a PCV10 or PCV13 serotype in 2011. Therefore, on the basis of serotype coverage alone, these results support the decision to shift to a vaccine of higher valence.

Other serotypes among the 10 most commonly reported in 2011 include 22F, 8, 14, 12F, 6C and 4. Serotypes 14 and 4 are both included in PCV7, 10 and 13. The continued circulation of some PCV7 serotypes may reflect the fact that the vaccine is not recommended across Europe and in some countries is only recommended for risk groups.

Serotypes 22F, 8 and 12F are included in the PPV23 vaccine, but not in any PCV vaccine. Although PCV13 has been authorised for use in adults over 50 years, the data suggest that PPV23 continues to be relevant for the vaccination of adults in risk groups, since PCV13 does not cover these important serotypes. PPV23 is currently recommended for adults and for children in risk groups from the age of two years.

Serotype 6C is the only top 10 serotype not currently covered by a licensed vaccine. It was reported in 2.6% of cases for which information on serotype was available, mainly in adults aged 15 years and over. Resistance to erythromycin (4.8%, n=90) was also observed. Serotype 6C was first described only a few years ago [16] and prevalence in nasopharyngeal carriage of this serotype in certain settings after vaccination has increased [17, 18]. However, there is evidence that PCV13 has the potential to confer cross-protection against serotypes not directly covered by the vaccine, such as 6C [19, 20]. This finding also supports the idea of introducing PCV13 into national vaccination schemes.

One of the major challenges in pneumococcal vaccination is serotype replacement. This phenomenon has been widely described [26–30] and it is to be expected that over time, as the valence of conjugate vaccines increases, the amount of replacement will also increase. As only two years of serotype data were available for IPD (2010–2011), it is difficult to draw conclusions on serotype replacement at European level as yet. The emergence of non-vaccine serotypes must be carefully monitored in order to assess interventions and inform the development of new vaccines.

Invasive pneumococcal disease displays a seasonal pattern which is even more evident in older age groups. There may be a number of factors involved including co-infection with respiratory viruses (influenza, syncytial respiratory virus, etc.) or temperature and environmental conditions [21–25]. A stronger commitment on recommendations for vaccines in the older age group may be required (influenza, PCV13 and PPV23 vaccines). Furthermore, it is recommended that the serotypes most commonly found in older age groups (3, 22F, 8, 6C and 4) be closely monitored to detect any shift to younger age groups.

The overall case–fatality rate was 10.3% and varied markedly from 0% (Denmark reported no deaths) to 28.6% (Lithuania). These figures should be interpreted cautiously due to the incompleteness of the variable 'outcome' (74.0% missing). In addition, there is no common definition of the point in time at which a fatal outcome is determined.

[15] http://venice.cineca.org/VENICE_Survey_PNC_1_2012-02-24.pdf

[16] http://vaccine-schedule.ecdc.europa.eu/Pages/Scheduler.aspx

Among the most frequent serotypes, serotype 3 accounted for the highest number of deaths (n=63). This serotype has been associated with a high invasive capacity [31] and increased case–fatality [32]. Serotype 11A (included in PPV23) accounted for the highest serotype-specific fatality rate in 2011 (25.3%). The third highest serotype-specific CFR was in serotype 23A (16.4%), which is not covered by any licensed vaccine (PCV7, 10, 13 and PPV23). This information should be interpreted with caution due to the small number of cases for which serotype and outcome was known.

Erythromycin is the antibiotic with the highest level of non-susceptibility (23.5%), followed by penicillin (17.2%). Simultaneous resistance to penicillin, erythromycin and cefotaxime (multi-drug resistance) was observed in serotypes 14, 19, 19A, 19F, 23F and 6B. Serotypes 19A, 14, 19F and 23F are considered to be the most antimicrobial-resistant [33,34].

There are notable differences in antimicrobial susceptibility testing results for EARS-Net and IPD surveillance. This may be explained by differences in the surveillance systems. Laboratory-based systems for the surveillance of *S. pneumoniae* with limited national coverage are used in EARS-Net while mainly population-based surveillance systems with nationwide coverage are used for IPD surveillance. There are also differences in case definitions (only blood and CSF for EARS-Net whereas IPD surveillance collects data from all sterile sites). One further significant factor is that EARS-Net does not analyse data from countries that submit less than 20 isolates, while IPD surveillance does not restrict the number of cases for analysis.

The most frequent clinical presentation was septicaemia, accounting for 77% of cases. This does not appear to be in line with previous observations, where pneumonia is the most commonly reported clinical presentation [15,35,36]. However, this difference is a consequence of the terms used to define clinical presentation in this report. In the data collection for this report the clinical presentation of cases could not be recorded as 'bacteraemia' or 'bacteraemia/pneumonia'. Instead 'septicaemia' or 'septicaemia/pneumonia' were used. Therefore cases of bacteraemia or bacteraemia/pneumonia may have had to be reported as septicaemia or septicaemia/pneumonia. If this is taken into account the findings in this report match the literature. In future reports it will be possible for IPD data on clinical presentation to be reported as 'bacteraemia' or 'bacteraemia/pneumonia'. *S. pneumoniae* is considered to be the leading bacterial cause of pneumonia and is reported as a major cause of hospital admissions for children and adults [15].

Invasive *Haemophilus influenzae* disease

In EU/EEA countries, invasive *H. influenzae* disease has become rare, with an overall notification rate of 0.58 per 100 000 population. As in previous years, higher rates were observed in north-western Europe. This may be due to better case ascertainment and reporting. Hib vaccination has led to a significant decrease in invasive bacterial infections in children, however the highest notification rates are still reported for children under one year of age (3.4 per 100 000), followed by adults aged 65 years and over (1.6 per 100 000).

The epidemiological characteristics of *H. influenzae* disease appear to be changing as the incidence of serotype b infection in children decreases and non-capsulated/non-b serotype infections in adults increase [40,46,48]. However, it should be highlighted that there is still a significant burden of disease in children. In Europe, the highest notification rate was observed in non-capsulated strains among cases aged less than one year (1.62 per 100 000). Non-capsulated strains made up the majority (77%) of cases of invasive *H. influenzae* disease in 2011, as has been reported elsewhere [45], and overall an upward trend was observed.

H. influenzae type b was a major cause of morbidity and mortality prior to the introduction of conjugate vaccines. However, since the introduction of routine childhood Hib vaccination programmes, invasive *H. influenzae* type b disease has substantially decreased in Europe [43,48,49], and is continuing to decrease, particularly in cases aged under five years. During the period 2008-2011 almost all Member States reported notification rates <1 per 100 000 population, except for Lithuania (2008), the Netherlands (2009 and 2010) and Estonia (2011). The rate of invasive *H. influenzae* serotype b disease among <5 year olds is used as the main indicator of the burden of disease. In 2011, the overall notification rate for serotype b infection was <0.1 per 100 000 in Europe.

Among non-b serotype infections there is a decrease in cases under one year of age and an increase in cases aged 65 years or over. In 2011, the notification rate for cases aged 65 years or over (0.15 per 100 000) surpassed that of cases aged under one year (0.11 per 100 000). Among non-b serotypes, serotype f was isolated in 69.6% of cases, as has been found elsewhere [40,43,46,47].

There have been some concerns about serotype replacement as a consequence of the conjugated *H. influenzae* type b vaccine [39–42]. Although increased incidence of non-b and non-capsulated strain infection has been observed in recent years, current literature suggests that there has been no evidence of this since the introduction of the vaccine in national immunisation schedules [43–47]. The increased reporting of non-b and non-capsulated strains over the years may be partly explained by the extension of enhanced surveillance systems to include all serotypes and/or clinical presentations and an increased awareness among clinicians due to these changes. At European level, more robust surveillance data is needed if serotype replacement is to be accurately assessed, particularly with regard to serotype data, which were missing in 50.7% of cases in 2011.

As in the previous years, the majority of cases suffered from septicaemia. Non-b and b serotypes were more prominent in cases of meningitis with non-capsulated serotypes more commonly associated with septicaemia. Pneumonia was reported across all serotypes. Clinical presentation is known to be associated with different serotypes and strongly related to age (50,51) although these results must be interpreted with caution as data on clinical presentation was missing for 54.4% of cases.

The case–fatality rate overall was 11.0% and varied markedly from 0% (seven countries reported no deaths) to 24.2% (Italy). These figures should be interpreted cautiously due to the incompleteness of the variable 'outcome' (46.9% missing). Moreover, there is no common definition of the point in time at which a fatal outcome is determined. Non-capsulated strains had the highest CFR (13.8%). The association of non-caps strains with higher CFR has been described elsewhere [37,42].

Invasive meningococcal disease

IMD remains rare in Europe, with an overall notification rate of 0.77 per 100 000 population. Notification rates in most countries are below 1 per 100 000 population, with the highest rate observed in Ireland (1.99 per 100 000). Overall, there has been a 20.2% reduction in cases in Europe since 2008.

As in previous years, children aged <5 years were the most affected, although incidence is decreasing. This trend is most notable in cases aged <1 year, in which the notification rate has fallen from 20.7 per 100 000 in 2008 to 12.3 in 2011. There was also a small peak in cases aged 15–24 years, a trend observed across most Member States. IMD is often higher in three age ranges; in infants and children aged <5 years, adolescents and young adults, and adults aged ≥65 years [57, 58].

Serogroup data completeness has improved on past years, reaching 91.9% completion in 2011. Overall, the distribution of serogroups varied considerably between countries, partly depending on whether routine MCC vaccination had been introduced. For example, in Denmark and Hungary, where MCC vaccination has not been introduced, serogroup C represented 50.0% and 49.3% of cases respectively.

In Europe, 73.6% of IMD was caused by serogroup B in 2011 and it was most prominent in infants aged <1 year (10.0 per 100 000) and 1-4 year olds (3.3 per 100 000). In <1 year olds, 88.3% of cases (n=535) were due to serogroup B, although there is a decreasing trend in this age group, driven by falling case numbers in the UK.

Serogroup B has been a strong candidate for vaccination and, following successful clinical trials [59], a vaccine against a large proportion of serogroup B strains was recently granted a licence from the European Commission and will soon be available for possible inclusion in the childhood immunisation programmes[17]. This means that for the first time vaccines to prevent the five serogroups causing most IMD worldwide might become available.

There is also a slight overall decrease in serogroup C infection, the second most common cause of IMD (14.4% of cases). Like serogroup B, the largest age-specific notification rate for serogroup C infections was in children aged <1 year (0.92 per 100 000) and 1-4 years (0.36 per 100 000). These rates are now 10-fold lower than for cases of serogroup B infection in the same age groups.

Since its introduction, the MCC vaccine has proved effective in reducing the burden of serogroup C infection [54,55,56] and encouraging the development of herd immunity [60]. Notification rates of serogroup C disease were higher in countries without Meningococcal C conjugate (MCC) vaccination across all age groups. Moreover, from 2008-2011, in cases aged <5 years a decrease was observed in serogroup C infection in countries with MCC, whereas a stable trend was observed in countries without MCC vaccination.

The vaccine is most often administered to young children, however, serogroup C carriage rates are highest in adolescents and young adults [61] which encourages transmission within the population. Therefore, high levels of immunity in this age group are critical to ensuring the protection of other vulnerable age groups [57], especially as it is well documented that the effectiveness of the MCC vaccine wanes over time [60–63]. MCC vaccination of adolescents and young adults should be considered while vaccination vigilance needs to be maintained. Previously, catch-up campaigns in adolescents and young adults have proved crucial in some countries for maintaining adequate levels of herd immunity [60, 64]. Currently, fifteen countries in Europe have MCC vaccination in their routine national immunisation programmes, eight of which offer vaccination after 11 years of age[18].

Serogroup Y infection is the only serogroup in which an increasing trend was observed, in line with recent findings from around Europe [65]. ECDC currently has no complete overview of the surveillance of serogroup Y in place in the Member States [66]. Increasing the quality of surveillance and the availability of molecular typing methods should eventually also lead to improved characterisation of serogroup Y isolates in Europe. Serogroup Y is included in a currently licensed vaccine also including serogroups A, C and W135 and is most common in the elderly [58].

Serogroup A has largely disappeared from Europe, however sporadic cases are reported.

[17] http://www.ema.europa.eu/docs/en_GB/document_library/EPAR_-_Summary_for_the_public/human/002333/WC500137857.pdf

[18] http://vaccine-schedule.ecdc.europa.eu/Pages/Scheduler.aspx

Meningococcal meningitis was the most commonly reported clinical presentation in 2011, contributing to 42.6% of cases, and it occurred in all age groups. Septicaemia also occurred across all ages and was reported in 33.1% of cases. Results should be interpreted with caution as data on clinical presentation was missing for 49.1% of cases and may be influenced by differences in clinical and surveillance practices within Member States. In some countries, meningitis is the main or only syndrome under surveillance, while the proportion of septicaemia is heavily influenced by blood culture practices in Member States and therefore likely to be underreported. There was no relationship observed between a specific clinical presentation and serogroup.

The case–fatality ratio is an important measure of the virulence of *N. meningitidis* and the effectiveness of treatment. The case–fatality rate overall was 8.7% and varied markedly from 0% (Cyprus and Greece reported no deaths) to 40.0% (Slovakia). The completeness of outcome data was good for IMD (16.9% missing), but these figures should still be interpreted cautiously as there is no common definition of the point in time at which a fatal outcome is determined.

Although the bacterial population found in IMD patients in 2011 was highly diverse, three main clones seem responsible for severe IMD in Europe: ST-41/44, ST-32 and ST-11. Molecular surveillance provides a better understanding of the epidemiology of IMD but it is only reported by a few countries (11 in 2011). As more Member States report on this variable the accuracy of the finding will improve.

5. Conclusions

IBD remain an important public health issue across Europe and continue to cause serious, preventable disease in several countries, particularly among the young and the elderly. Rates of invasive *H. influenzae* disease and IMD have been decreasing and both diseases remain rare in the majority of European countries. Trends are stable for IPD, however serotype replacement among vaccine and non-vaccine serotypes needs to be carefully monitored.

Vaccines have proved effective in reducing the burden of disease of IPD (PCV7, 10, 13/PPV23), invasive *H. influenzae* disease (Hib vaccine) and IMD (MCC vaccine) across Europe. However, with the changing epidemiology of each disease comes new challenges for vaccine policy from the introduction of a new vaccine (meningococcal group B), to the adjustment of current vaccine schedules (MCC vaccination in adolescents), to future vaccine development (PCV). Vaccine pre- and post-marketing surveillance must be maintained if the positive impact of vaccination is to be sustained in individuals and across populations. Effective surveillance is essential to achieve this.

The findings presented in this report are interesting both from an epidemiological and a public health perspective, however they also underline the importance of standardised, reproducible, laboratory and clinically based epidemiological surveillance. Surveillance systems for IBD remain very diverse across Europe, which impacts on the comparability of data between countries and the accuracy of data interpretation at European level. A stronger understanding of surveillance systems and laboratory practices in different Member States, as well as better linkage between notification and laboratory data at national level would help produce a more accurate interpretation of the data. Comprehensive and continued reporting on enhanced variables, such as serotypes/serogroups, is needed as such data can provide invaluable information for the development of future vaccine and policy.

6. Strengths and limitations

The ECDC report *Surveillance of Invasive Bacterial Diseases in Europe, 2011* enables data on IPD, invasive *H. influenzae* disease and IMD from many Member States to be pooled at a supranational level. The aim is to provide comprehensive baseline information on the epidemiology of IBD in EU/EEA countries to determine the burden of disease at the European level. This will in turn facilitate the prioritisation of policies, assessment of the impact of vaccination and the development of future vaccines. It also allows data to be compared with other regions of the world. A certain degree of under-diagnosis and under-reporting is suspected for all three diseases.

A key challenge in IBD surveillance across Europe is that national surveillance systems for all three diseases are heterogeneous which hampers comparisons between Member States. Most data come from comprehensive surveillance systems and in the majority of countries epidemiological and laboratory data are merged at national level. However, there are some countries where this is still not possible. Differences also exist between healthcare systems, health-seeking behaviour, diagnostics, laboratory methods and medical practices (e.g. blood culture testing). In addition, changes in surveillance systems (availability of new laboratory methods, comprehensiveness of the system, extension of age groups, a broader coverage of serogroup/serotype, clinical forms of the disease under surveillance and improved case ascertainment) complicate the analysis of data over time, even within countries.

One positive point is that the majority of countries for all three diseases reported that they applied the 2008 version of the EU case definitions[19]. The remaining few used the 2002 version, other case definitions, or did not specify which ones they had used. The use of different EU case definitions should not have affected data analysis, as the criteria for a confirmed case of IPD, invasive *H. influenzae* disease or IMD in both case definitions are identical or almost identical. Moreover, probable cases of IMD only accounted for 2% of all cases.

One difference between countries is in the sensitivity and availability of laboratory methods used for case confirmation. IPD is a good example of this where, for both serotyping and antimicrobial resistance testing, often only one method was used by each country with a variety of methods used between countries. This must be considered when making direct comparisons between laboratory variables for IPD between countries. Furthermore, for IPD some isolates were only characterised to the serogroup level (i.e. serogroup 7, 19, etc.) showing limited capacity for serotyping testing in some labs. For both invasive *H. influenzae* disease and IMD, culture was the most frequently reported laboratory method used for confirming a case. Laboratory capacities have improved over the years and nucleic acid detection and genotyping results have increasingly been reported, although at this point in time routine use of these techniques for strain characterisation still appears to be limited in the majority of Member States.

The completeness of reporting differed between variables and across countries. In 2011, no variable was reported as 100% unknown and, although there are still important gaps in the data, data completeness is improving for all three diseases. For example, for invasive *H. influenzae* disease serotype data has become more complete each year since 2008, although 50.7% of this data was still unknown in 2011. Gaps in the surveillance data for this and other variables such as vaccination status, outcome, clinical presentation, antimicrobial resistance and MLST typing remain and data quality must continue to improve if more accurate conclusions regarding these variables, and their significance across Europe, are to be drawn in the future.

Furthermore, with regard to outcome data; a high CFR in countries with low notification rates may indicate a bias in their data towards reporting the most severe outcomes. A low CFR in countries with high notification rates may in turn reflect a situation where deaths were occurring after the disease was notified. There is no common definition of the point in time at which a fatal outcome is determined. Outcome data accuracy might also be influenced by variations in surveillance systems: countries with hospital discharge data included in their routine surveillance might have higher outcome data completeness and, as a result, a higher case–fatality ratio.

The absence of certain data from this report is another limitation. For example, serotype data was not available for IPD for the years before 2010. Serotype replacement is an important issue in the surveillance of IPD and for the development of new vaccines. In future reports more years of serotype data will be available, which will allow better analysis of the changing epidemiology of IPD, data essential in helping to inform future vaccine development and policy. Data on the nasopharyngeal carriage of serotypes would also be useful.

Caution must also be taken when comparing this report with other ECDC publications that describe the epidemiology of IPD, invasive *H. influenzae* disease or IMD (e.g. the annual epidemiological report[20], the surveillance report on IPD in Europe 2010[21], or the surveillance report on invasive bacterial diseases in Europe 2008/2009[22]) as there may be differences in how the data is analysed between reports, which can produce

[19] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:159:0046:0090:EN:PDF

[20] http://www.ecdc.europa.eu/en/publications/publications/annual-epidemiological-report-2012.pdf

[21] http://www.ecdc.europa.eu/en/publications/Publications/invasive-pneumoccocal-disease-surveillance-2010.pdf

[22] http://ecdc.europa.eu/en/publications/Publications/1107_SUR_IBD_2008-09.pdf

differences between the exact figures presented. Furthermore, in TESSy countries may update their data for any given year at any time. This may also explain any variation in the figures presented between this and previous reports.

Overall, the epidemiological trends presented in this report match those of previous reports. However, trends should still be compared to previous reports with caution as countries included in trend figures in this report are only those who reported consistently from 2008–2011, which may not be the same as countries reporting consistently for other time periods. It is important to consider that in small countries small changes in numbers may cause large differences in rates and ratios.

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Annex 1

Table A1. Description of the data sources for surveillance data on pneumococcal infections, reporting year 2011

						Data reported by					
Country	**Data source**	**Legal character**	**Comprehensive / sentinel**	**Active / passive**	**Case-based / - aggregated**	**Labs**	**Physi-cians**	**Hosp.**	**Others**	**Case def.**	**National coverage**
Austria	AT-Epidemiegesetz	Cp	Co	P	C	Y	Y	Y	Y	EU'08	Y
Belgium	BE-REFLAB	V	Se	A	C	Y	N	N	N	EU'08	Y
Bulgaria	BG-NATIONAL_SURVEILLANCE	Cp	Co	P	A	Y	Y	Y	Y	EU'02	Y
Cyprus	CY-LABNET	V	Se	A	C	Y	N	N	N	none	N
Czech Republic	CZ-EPIDAT	Cp	Co	A	C	N	Y	Y	N	EU'08	Y
Czech Republic	CZ-NRL-STR	Cp	Co	A	C	Y	Y	Y	N	EU'08	Y
Denmark	DK-MIS	Cp	Co	P	C	N	Y	N	N	Other	Y
Estonia	EE-PNEUMOCOCC	Cp	Co	P	C	Y	Y	Y	Y	EU'08	Y
Finland	FI-NIDR	Cp	Co	P	C	Y	N	N	N		Y
France	FR-EPIBAC	V	Se	A	C	Y	N	Y	N	EU'08	Y
France	FR-PNEUMO-NRL	V	Se	A	C	Y	N	N	N	EU'08	Y
Greece	GR-Notification/Laboratory data	Cp	Co	P	C	Y	Y	Y	Y	EU'08	Y
Hungary	HU-NRL_PNEU	V	Co	P	C	Y	N	N	N	EU'08	Y
Iceland	IS-SUBJECT_TO_REGISTRATION	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Ireland	IE-PNEU	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Italy	IT-MENINGITIS	Cp	Co	P	C	N	Y	Y	N	EU'08	Y
Latvia	LV-BSN	Cp	Co	P	C	Y	Y	Y	Y	EU'08	Y
Lithuania	LT-COMMUNICABLE_DISEASES	Cp	Co	P	C	Y	Y	N	N		Y
Luxembourg	LU-SYSTEM1	V	Co	P	C	U	Y	N	N	none	
Malta	MT-DISEASE_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	Y	EU'08	Y
Netherlands	NL-OSIRIS	Cp	Co	P	C	Y	Y	N	N	EU'08	Y
Netherlands	NL-NRBM	V	Se	P	C	Y	N	N	N	EU'08	N
Norway	NO-MSIS_A	Cp	Co	P	C	Y	Y	Y	N		Y
Poland	PL-NATIONAL_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Romania	RO-RNSSy	Cp	Co	P	C	N	N	Y	N	EU'08	Y
Slovakia	SK-EPIS	Cp	Co	A	C	Y	Y	Y	N	EU'08	Y
Slovenia	SI-SURVIVAL	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Spain	ES-NRL	V	O	P	C	Y	N	Y	N	Unk	U
Sweden	SE-SMINET	Cp	Co	P	C	Y	Y	N	N	EU'08	Y
United Kingdom	UK-PNEUMOCOCCAL	O	Co	P	C	Y	N	Y	Y	Other	Y

Cp: Compulsory, V: Voluntary, Co: Comprehensive, O: Other, Se: Sentinel, P: Passive, A: Active, C: Case-based, A: Aggregated, Y: Yes, N: No.

Table A2. Population coverage of the FR-EPIBAC data source from France

Age-group (years)	Population covered by surveillance 2011		
	Female	Male	Both
<1	289 992	303 065	593 057
1 to 4	1 139 941	1 189 930	2 329 871
5 to 14	2 818 951	2 957 650	5 776 601
15-24	2 851 593	2 945 889	5 797 482
25-49	7 812 716	7 680 176	15 492 892
50-64	4 740 475	4 474 425	9 214 900
≥65	4 790 599	3 421 240	8 211 840
All Ages	24 444 267	22 972 375	47 416 642

Table A3. Quality of 2011 data; distribution of known, unknown, not applicable and blank responses per variable for all reported cases of IPD by country, in EU/EEA countries (n=22 256*)

Variable	Known		Unknown		Blank		Overall missing
	N	%	N	%	N	%	%
Age**	22 213	99.8		0.0	43	0.2	0.2
AgeMonth***	1 175	97.1	35	2.9	0	0.0	2.9
Classification**	22 256	100.0	0	0.0	0	0.0	0.0
ClinicalPresentation	11 680	52.7	10 488	47.3	0	0.0	47.3
Gender**	22 192	99.7	64	0.3	0	0.0	0.3
Outcome	5 771	26.0	16 397	74.0	0	0.0	74.0
ResultMICSign_CTX	4 393	19.8	0	0.0	17 775	80.2	80.2
ResultMICSign_ERY	3 774	17.0	0	0.0	18 394	83.0	83.0
ResultMICSign_PEN	5 172	23.3	0	0.0	16 996	76.7	76.7
ResultMICValueCTX	5 815	26.2	0	0.0	16 353	73.8	73.8
ResultMICValueERY	4 850	21.9	0	0.0	17 318	78.1	78.1
ResultMICValuePEN	6 661	30.0	0	0.0	15 507	70.0	70.0
Serotype	16 378	73.9	930	4.2	4 860	21.9	26.1
SIR_CTX	6 489	29.3	1 875	8.5	13 804	62.3	70.7
SIR_ERY	7 394	33.4	1 818	8.2	12 956	58.4	66.6
SIR_PEN	7 429	33.5	1 785	8.1	12 954	58.4	66.5
Specimen	21 245	95.8	893	4.0	30	0.1	4.2
TestMethodMIC	8 378	37.8	38	0.2	13 752	62.0	62.2
TestMethodTyping	10 853	49.0	4 796	21.6	6 519	29.4	51.0
VaccStatus	3 222	14.5	18 946	85.5	0	0.0	85.5
VaccType	13 746	62.0	8 422	38.0	0	0.0	38.0

** N includes aggregated data that is only considered in the variables Age, Classification and Gender. Data from FR-EPIBAC and FR-PNEUMO-NRL is also included for France. The data presented in 'Results' differs from the data presented in Table SP1 as in the 'Results' only one of these data sources is considered for each individual variable.*

*** Includes case-based and aggregated data*

**** AgeMonth is reported only for cases with age <2 years*

Table A4. Distribution of specimens among reported IPD cases by specimen type and country, EU/EEA countries, 2011 (n=16 208)

Country	Blood		CSF*		Total
	N	%	N	%	N
Austria	85	78.7	23	21.3	108
Belgium	1 766	96.2	70	3.8	1 836
Cyprus	10	83.3	2	16.7	12
Czech Republic	288	84.2	54	15.8	342
Denmark	848	92.4	70	7.6	918
Estonia	7	58.3	5	41.7	12
Finland	754	96.8	25	3.2	779
France	1 002	70.9	411	29.1	1 413
Greece	6	14.6	35	85.4	41
Hungary	63	58.9	44	41.1	107
Ireland	303	93.8	20	6.2	323
Italy	453	64.4	250	35.6	703
Lithuania	3	100.0	0	0.0	3
Malta	10	90.9	1	9.1	11
Netherlands	598	93.3	43	6.7	641
Poland	105	54.4	88	45.6	193
Romania	8	14.0	49	86.0	57
Slovakia	26	55.3	21	44.7	47
Slovenia	253	99.2	2	0.8	255
Spain	1 993	91.3	190	8.7	2 183
Sweden	1 281	95.7	58	4.3	1 339
United Kingdom	4 033	97.7	93	2.3	4 126
EU total	**13 895**	**89.9**	**1 554**	**10.1**	**15 449**
Iceland	26	83.9	5	16.1	31
Norway	686	94.2	42	5.8	728
EU/EEA total	**14 607**	**90.1**	**1 601**	**9.9**	**16 208**

** CSF = Cerebrospinal fluid*

Table A5. Distribution of specimens among reported IPD cases by specimen type and age group*, EU/EEA countries, 2011 (n=16 176)

Specimen	<1 year		1-4 years		5-14 years		15-64 years		≥65 years		Total
	N	%	N	%	N	%	N	%	N	%	
Blood	361	73.2	1 030	90.0	479	84.0	5 893	87.9	6 807	93.7	14 570
CSF**	132	26.8	114	10.0	91	16.0	815	12.1	454	6.3	1 606
Total	493		1 144		570		6 708		7 261		16 176

Table A6. Distribution by month of reported IPD cases by country, EU/EEA countries, 2011 (n=20 839)

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Austria	17	22	18	23	18	8	5	4	1	7	16	19
Belgium	197	192	213	192	162	148	82	53	94	126	149	228
Bulgaria	3	5	4	6	2	3	2	0	4	3	1	4
Cyprus	1	1	2	1	0	1	0	2	1	0	0	3
Czech Republic	38	38	50	55	41	22	17	12	10	26	36	39
Denmark	111	103	112	106	69	61	39	22	42	51	71	137
Estonia	2	1	2	1	3	0	1	2	2	3	0	1
Finland	78	74	83	79	100	54	29	31	63	67	47	74
France	712	650	490	517	324	339	275	145	203	387	360	635
Greece	6	8	2	2	6	2	2	2	3	4	2	2
Hungary	11	12	18	12	14	3	2	2	4	10	9	10
Iceland	2	2	4	2	6	2	0	3	1	2	6	3
Ireland	40	31	40	28	33	52	18	21	22	12	24	36
Italy	56	81	67	77	48	34	26	30	34	98	78	84
Latvia	0	5	6	5	5	5	1	2	1	5	4	12
Lithuania	0	0	2	1	1	0	0	1	1	0	1	2
Malta	2	1	1	2	0	1	0	2	0	0	0	2
Netherlands	60	90	75	75	57	44	32	15	17	47	43	86
Norway	88	62	75	69	65	38	26	31	61	62	64	88
Poland	21	30	41	42	34	22	19	16	6	35	40	45
Romania	5	6	11	9	8	8	7	2	4	10	13	7
Slovakia	3	5	7	3	3	1	3	1	2	5	3	21
Slovenia	35	34	26	20	24	14	11	4	13	22	23	29
Spain	350	322	260	208	144	129	71	86	63	184	171	232
Sweden	144	104	158	156	166	110	56	30	79	92	125	141
United Kingdom	659	488	502	496	313	346	244	180	190	271	365	574
Total	**2 641**	**2 367**	**2 269**	**2 187**	**1 646**	**1 447**	**968**	**699**	**921**	**1 529**	**1 651**	**2 514**

Table A7. Distribution by age group of reported IPD cases by country, EU/EEA countries, 2011 (n=20 712)

Country	<1 year		1-4 years		5-14 years		15-24 years		25-49 years		50-64 years		≥65 years	Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Austria	6	3.8	13	8.2	7	4.4	3	1.9	17	10.8	42	26.6	70	44.3	158
Belgium	97	5.3	237	13.1	86	4.7	32	1.8	290	16.0	328	18.1	745	41.0	1 815
Bulgaria*															
Cyprus	0	0.0	0	0.0	0	0.0	1	9.1	0	0.0	2	18.2	8	72.7	11
Czech Republic	6	1.6	18	4.7	26	6.8	8	2.1	71	18.5	125	32.6	130	33.9	384
Denmark	12	1.3	21	2.3	25	2.7	16	1.7	129	14.0	219	23.7	502	54.3	924
Estonia	0	0.0	3	16.7	1	5.6	0	0.0	6	33.3	5	27.8	3	16.7	18
Finland	11	1.4	61	7.8	14	1.8	29	3.7	144	18.5	222	28.5	298	38.3	779
France	151	3.0	246	4.9	160	3.2	113	2.2	857	17.0	1 107	22.0	2 403	47.7	5 037
Greece	3	7.3	1	2.4	5	12.2	1	2.4	14	34.1	10	24.4	7	17.1	41
Hungary	1	0.9	13	12.3	6	5.7	3	2.8	21	19.8	30	28.3	32	30.2	106
Ireland	10	2.8	31	8.7	12	3.4	6	1.7	66	18.5	67	18.8	165	46.2	357
Italy	18	2.5	46	6.5	18	2.5	10	1.4	113	15.9	115	16.2	392	55.1	712
Latvia*															
Lithuania	3	33.3	1	11.1	1	11.1	0	0.0	4	44.4	0	0.0	0	0.0	9
Malta	0	0.0	1	10.0	0	0.0	0	0.0	1	10.0	1	10.0	7	70.0	10
Netherlands	10	1.6	6	0.9	12	1.9	8	1.2	89	13.9	174	27.1	342	53.4	641
Poland	21	6.0	43	12.3	20	5.7	14	4.0	60	17.1	114	32.6	78	22.3	350
Romania	4	4.5	10	11.2	11	12.4	8	9.0	19	21.3	18	20.2	19	21.3	89
Slovakia	4	7.0	1	1.8	2	3.5	2	3.5	13	22.8	21	36.8	14	24.6	57
Slovenia	10	3.9	47	18.4	5	2.0	5	2.0	31	12.2	57	22.4	100	39.2	255
Spain	78	3.5	214	9.6	76	3.4	30	1.4	389	17.5	482	21.7	951	42.8	2 220
Sweden	12	0.9	29	2.1	21	1.5	18	1.3	195	14.3	353	25.9	733	53.9	1 361
United Kingdom	103	2.2	239	5.2	130	2.8	138	3.0	938	20.3	959	20.8	2 109	45.7	4 616
EU total	**560**	**2.8**	**1 281**	**6.4**	**638**	**3.2**	**445**	**2.2**	**3 467**	**17.4**	**4 451**	**22.3**	**9 108**	**45.7**	**19 950**
Iceland	0	0.0	3	9.1	1	3.0	0	0.0	5	15.2	11	33.3	13	39.4	33
Norway	11	1.5	17	2.3	18	2.5	14	1.9	103	14.1	184	25.2	382	52.4	729
EU/EEA total	**571**	**2.8**	**1 301**	**6.3**	**657**	**3.2**	**459**	**2.2**	**3 575**	**17.3**	**4 646**	**22.4**	**9 503**	**45.9**	**20 712**

** Aggregated data reported, exact number of cases in these age groups could not be determined*

Table A8. Notification rate of reported IPD cases by age group, EU/EEA countries, 2008–2011 (n=53 235)

Age group	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
< 1 year	359	12.94	355	12.79	344	12.40	295	10.63
1-4 years	868	7.86	778	7.04	913	8.26	760	6.88
5-14 years	362	1.40	394	1.53	327	1.27	378	1.46
15-64 years	5 695	3.38	5 285	3.14	6 248	3.71	5 695	3.38
≥65 years	5 815	13.12	5 407	12.20	6 727	15.18	6 230	14.06

Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Slovakia, Slovenia, Spain, Sweden and the United Kingdom

Table A9. Distribution of reported IPD cases by clinical presentation and country, EU/EEA countries, 2011 (n=11 680)

Country	Meningitis/ septicaemia		Meningitis		Septicaemia		Pneumonia/ septicaemia		Other		Total
	N	%	N	%	N	%	N	%	N	%	N
Austria	11	10.5	16	15.2	18	17.1	18	17.1	42	40.0	105
Belgium	0	0.0	70	3.8	1766	96.2	0	0.0	0	0.0	1836
Cyprus	0	0.0	2	16.7	5	41.7	5	41.7	0	0.0	12
Czech Republic	16	4.2	77	20.1	99	25.8	192	50.0	0	0.0	384
Denmark	0	0.0	70	7.6	848	92.4	0	0.0	0	0.0	918
Estonia	1	5.6	7	38.9	10	55.6	0	0.0	0	0.0	18
Greece	13	31.7	28	68.3	0	0.0	0	0.0	0	0.0	41
Hungary	8	9.8	36	43.9	11	13.4	20	24.4	7	8.5	82
Ireland	7	5.3	16	12.1	42	31.8	67	50.8	0	0.0	132
Italy[a]	0	0.0	260	36.5	235	33.0	218	30.6	0	0.0	713
Lithuania	0	0.0	0	0.0	9	100.0	0	0.0	0	0.0	9
Malta	0	0.0	0	0.0	0	0.0	0	0.0	11	100.0	11
Poland	46	13.3	124	35.7	98	28.2	6	1.7	73	21.0	347
Romania	0	0.0	52	57.8	2	2.2	29	32.2	7	7.8	90
Slovakia	2	3.5	18	31.6	16	28.1	0	0.0	21	36.8	57
Slovenia	0	0.0	2	5.4	11	29.7	21	56.8	3	8.1	37
Spain	0	0.0	190	8.7	1887	86.4	106	4.9	0	0.0	2183
United Kingdom	69	1.6	69	1.6	3854	89.2	45	1.0	283	6.6	4320
EU Total	**173**	**1.5**	**1 037**	**9.2**	**8 911**	**78.9**	**727**	**6.4**	**447**	**4.0**	**11 295**
Norway	15	3.9	16	4.2	120	31.2	190	49.4	44	11.4	385
EU/EEA total	**188**	**1.6**	**1 053**	**9.0**	**9 031**	**77.3**	**917**	**7.9**	**491**	**4.2**	**11 680**

a Italy does not follow this classification. All cases of meningitis/septicaemia were classified as meningitis by the country.

Table A10. Case–fatality rate due to IPD in EU/EEA countries*, 2011 (n=5 771)

Country	No. of cases	No. of cases with known outcome	No. of deaths	CFR (%)	95% Confidence interval (%)
Austria	158	158	13	8.2	4.5 - 13.7
Belgium	1 836	1 198	71	5.9	4.7 - 7.4
Cyprus	12	8	0	0.0	0.0 - 36.9
Czech Republic	384	349	52	14.9	11.3 - 19.1
Denmark	924	3	0	0.0	0.0 - 70.8
Estonia	18	18	2	11.1	1.4 - 34.7
Greece	41	17	3	17.6	3.8 - 43.4
Hungary	107	33	5	15.2	5.1 - 31.9
Ireland	357	104	4	3.8	1.1 - 9.6
Italy	713	521	56	10.7	8.2 - 13.7
Lithuania	9	7	2	28.6	3.7 - 71.0
Malta	11	11	1	9.1	0.2 - 41.3
Norway	729	331	35	10.6	7.5 - 14.4
Poland	351	351	63	17.9	14.1 - 22.4
Romania	90	90	13	14.4	7.9 - 23.4
Slovakia	57	50	12	24.0	13.1 - 38.2
Slovenia	255	255	10	3.9	1.9 - 7.1
Sweden	1 361	1 361	148	10.9	9.3 - 12.7
United Kingdom	4 632	906	104	11.5	9.5 - 13.7
Total	**12 045**	**5 771**	**594**	**10.3**	**9.5 - 11.1**

** Only 'unknown' outcomes reported by Finland, France, Iceland, Netherlands and Spain.*

Table A11. Number of cases, total number of deaths and case–fatality rate due to IPD by clinical presentation in EU/EEA countries*, 2011

Clinical presentation	Deaths	Number of cases	CFR
Meningitis/Septicaemia	13	121	10.7%
Meningitis	92	604	15.2%
Septicaemia	253	2 577	9.8%
Pneumonia/Septicaemia	44	626	7.0%
Other	28	187	15.0%
Total	**430**	**4 115**	**10.4%**

Table A12. Number of cases, total number of deaths and case–fatality rate due to IPD by age group in EU/EEA countries, 2011 (n=5 756)

Age group	Deaths	Number of cases	CFR
<1 year	9	175	5.1%
1-4 years	13	436	3.0%
5-14 years	15	211	7.1%
15-64 years	191	2 380	8.0%
≥65 years	366	2 554	14.3%
Total	**594**	**5 756**	**10.3%**

Table A13. Distribution of reported IPD cases by top 10 serotype and country, EU/EEA countries, 2011 (n=15 339*)**

Country	Serotype 7F*		Serotype 19A~		Serotype 3~		Serotype 1*		Serotype 22F^		Serotype 8^		Serotype 14&		Serotype 12F^		Serotype 6C		Serotype 4&		Total***
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Austria	9	17.0	1	1.9	7	13.2	2	3.8	4	7.5	1	1.9	5	9.4	0	0.0	0	0.0	2	3.8	53
Belgium	78	4.2	122	6.6	119	6.5	327	17.8	17	0.9	42	2.3	29	1.6	30	1.6	0	0.0	17	0.9	1836
Cyprus	0	0.0	0	0.0	1	10.0	0	0.0	0	0.0	1	10.0	0	0.0	0	0.0	0	0.0	0	0.0	10
Czech Republic	37	11.2	10	3.0	43	13.0	37	11.2	12	3.6	11	3.3	22	6.7	6	1.8	1	0.3	16	4.8	330
Denmark	81	8.9	63	6.9	80	8.8	181	19.8	55	6.0	59	6.5	9	1.0	45	4.9	31	3.4	28	3.1	913
Finland	49	6.4	39	5.1	76	9.9	3	0.4	69	8.9	5	0.6	138	17.9	1	0.1	11	1.4	52	6.7	771
France	151	10.7	180	12.8	100	7.1	107	7.6	69	4.9	22	1.6	26	1.8	197	14.0	48	3.4	19	1.3	1409
Greece	1	12.5	1	12.5	0	0.0	0	0.0	0	0.0	0	0.0	3	37.5	0	0.0	0	0.0	0	0.0	8
Hungary	9	8.6	7	6.7	32	30.5	5	4.8	2	1.9	4	3.8	4	3.8	2	1.9	0	0.0	0	0.0	105
Ireland	32	11.3	32	11.3	16	5.7	7	2.5	25	8.9	24	8.5	8	2.8	1	0.4	6	2.1	9	3.2	282
Italy	13	7.4	21	11.9	18	10.2	24	13.6	12	6.8	7	4.0	6	3.4	2	1.1	5	2.8	4	2.3	176
Lithuania	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	33.3	0	0.0	0	0.0	0	0.0	3
Malta	0	0.0	1	50.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2
Netherlands	101	15.8	74	11.5	39	6.1	42	6.6	44	6.9	75	11.7	19	3.0	26	4.1	8	1.2	29	4.5	641
Poland	3	1.6	13	6.8	33	17.4	10	5.3	3	1.6	5	2.6	21	11.1	3	1.6	3	1.6	5	2.6	190
Romania	2	8.0	0	0.0	4	16.0	0	0.0	0	0.0	0	0.0	1	4.0	2	8.0	0	0.0	0	0.0	25
Slovakia	1	3.4	5	17.2	7	24.1	0	0.0	0	0.0	0	0.0	3	10.3	0	0.0	0	0.0	0	0.0	29
Slovenia	16	6.3	8	3.2	27	10.7	12	4.7	9	3.6	1	0.4	53	20.9	0	0.0	5	2.0	19	7.5	253
Spain	207	9.3	293	13.2	279	12.6	144	6.5	94	4.2	79	3.6	120	5.4	81	3.6	82	3.7	52	2.3	2220
Sweden	130	10.2	102	8.0	121	9.5	23	1.8	146	11.5	29	2.3	55	4.3	7	0.5	42	3.3	48	3.8	1273
United Kingdom	608	15.0	462	11.4	346	8.5	320	7.9	312	7.7	374	9.2	19	0.5	132	3.2	118	2.9	46	1.1	4062
EU total	**1 528**	**10.5**	**1434**	**9.8**	**1 348**	**9.2**	**1 244**	**8.5**	**873**	**6.0**	**739**	**5.1**	**542**	**3.7**	**535**	**3.7**	**360**	**2.5**	**346**	**2.4**	**14 591**
Iceland	0	0.0	0	0.0	2	6.7	1	3.3	0	0.0	0	0.0	5	16.7	0	0.0	0	0.0	1	3.3	30
Norway	119	16.6	91	12.7	44	6.1	49	6.8	82	11.4	21	2.9	6	0.8	8	1.1	41	5.7	27	3.8	718
EU/EEA total	**1 647**	**10.7**	**1525**	**9.9**	**1 394**	**9.1**	**1 294**	**8.4**	**955**	**6.2**	**760**	**5.0**	**553**	**3.6**	**543**	**3.5**	**401**	**2.6**	**374**	**2.4**	**15 339**

** Serotype protected against by 10- and 13-valent vaccines and PPV23*
~ Serotype protected against by the 13-valent vaccine and PPV23
& Serotype protected against by the 7-, 10- and 13-valent vaccines & PPV23
^ Serotype protected against by the PPV23
**** Total refers to all cases for which serotype is known by country*

Table A14. Distribution of ten most frequent IPD serotypes by age group, EU/EEA countries, 2011 (n=15 310*)

Serotype	<1 year		1-4 years		5-14 years		15-64 years		≥65 years	
	N	%	N	%	N	%	N	%	N	%
7F	47	10.2	81	7.4	67	12.3	911	14.3	541	7.9
19A	81	17.5	193	17.6	26	4.8	515	8.1	709	10.4
3	23	5.0	54	4.9	21	3.9	528	8.3	764	11.2
1	13	2.8	195	17.8	201	37.0	620	9.7	261	3.8
22F	13	2.8	43	3.9	11	2.0	381	6.0	507	7.4
8	12	2.6	4	0.4	9	1.7	423	6.6	309	4.5
14	19	4.1	57	5.2	12	2.2	225	3.5	240	3.5
12F	27	5.8	48	4.4	24	4.4	256	4.0	188	2.7
6C	5	1.1	11	1.0	3	0.6	122	1.9	260	3.8
4	3	0.6	9	0.8	6	1.1	213	3.3	143	2.1
Total*	463		1094		543		6373		6837	

** Total = total number of cases for which serotype information is available by age group*

Table A15. Distribution of ten most frequent IPD serotypes by gender, EU/EEA countries, 2011 (n=15 284*)

Serotype	Male		Female	
	N	%	N	%
7F	892	10.7	747	10.8
19A	768	9.2	752	10.8
3	790	9.5	600	8.6
1	702	8.4	586	8.4
22F	525	6.3	427	6.2
8	417	5.0	339	4.9
14	295	3.5	258	3.7
12F	303	3.6	237	3.4
6C	219	2.6	182	2.6
4	204	2.4	169	2.4

** Overall 55 missing cases for gender among all serotypes: serotype 7F (N missing=8), 19A (n=5), 3 (n=4), 1 (n=6), 22F (n=3), 8 (n=4), 14 (n=0), 12F (n=3), 6C (n=0) and 4 (n=1)*

Table A16. Distribution of non-PCV serotype IPD cases by age group, EU/EEA countries, 2011 (n=15 310)

Non-PCV Serotype	Number and % of cases			
	<15 years		All age groups	
	N	%	N	%
2	0	0.0	2	0.0
6	3	0.0	53	0.3
6C	19	0.1	401	2.6
6D	0	0.0	1	0.0
7	3	0.0	160	1.0
7A	0	0.0	5	0.0
7B	0	0.0	1	0.0
7C	3	0.0	6	0.0
8	25	0.2	757	4.9
9	3	0.0	33	0.2
9A	1	0.0	8	0.1
9L	1	0.0	5	0.0
9N	12	0.1	331	2.2
10	0	0.0	18	0.1
10A	47	0.3	235	1.5
10B	3	0.0	10	0.1
10F	0	0.0	15	0.1
11	0	0.0	27	0.2
11A	27	0.2	307	2.0
11B	0	0.0	7	0.0
11C	0	0.0	1	0.0
11D	1	0.0	6	0.0
11F	0	0.0	3	0.0
12	0	0.0	106	0.7
12B	0	0.0	5	0.0
12F	99	0.6	543	3.5
13	1	0.0	14	0.1
15	1	0.0	42	0.3
15A	43	0.3	269	1.8
15B	30	0.2	142	0.9
15B/C	0	0.0	1	0.0
15C	44	0.3	117	0.8
15F	0	0.0	1	0.0
16	1	0.0	20	0.1
16F	12	0.1	163	1.1
17	0	0.0	10	0.1
17A	1	0.0	5	0.0
17F	12	0.1	102	0.7
18	1	0.0	10	0.1
18A	1	0.0	10	0.1
18B	0	0.0	3	0.0
18F	0	0.0	5	0.0
19	7	0.0	158	1.0
19B	0	0.0	1	0.0
19C	0	0.0	2	0.0
20	3	0.0	113	0.7
21	9	0.1	32	0.2
22	0	0.0	57	0.4
22A	0	0.0	2	0.0
22F	67	0.4	955	6.2

Non-PCV Serotype	Number and % of cases			
	<15 years		All age groups	
	N	%	N	%
23	0	0.0	28	0.2
23A	10	0.1	247	1.6
23B	33	0.2	178	1.2
24	2	0.0	16	0.1
24A	1	0.0	6	0.0
24B	4	0.0	5	0.0
24F	62	0.4	184	1.2
25A	12	0.1	26	0.2
25F	0	0.0	3	0.0
27	9	0.1	13	0.1
28	0	0.0	6	0.0
28A	0	0.0	8	0.1
28F	1	0.0	1	0.0
29	3	0.0	34	0.2
31	3	0.0	104	0.7
33	1	0.0	27	0.2
33A	0	0.0	1	0.0
33F	46	0.3	306	2.0
34	2	0.0	34	0.2
35	2	0.0	9	0.1
35B	19	0.1	129	0.8
35C	0	0.0	1	0.0
35F	16	0.1	168	1.1
37	1	0.0	8	0.1
38	23	0.2	128	0.8
39	1	0.0	2	0.0
40	1	0.0	1	0.0
46	0	0.0	1	0.0
NTYP	2	0.0	15	0.1
O	0	0.0	1	0.0

Table A17. Overview - Proportion of resistance in EARS-Net vs. IPD surveillance in 2011

Country	Penicillin R				Macrolide R			
	EARS-Net		IPD surveillance		EARS-Net		IPD surveillance	
	Total N	%R	Total N	%R	Total N	%R	Total N	%R
Austria*	405	1.70%	4	0.00%	373	11.50%	1	0.00%
Belgium	1 829	0.80%	1 833	0.80%	1 829	26.00%	1 833	26.00%
Bulgaria	33	21.20%	-	-	30	13.30%	-	-
Cyprus	12	25.00%	12	25.00%	12	25.00%	12	25.00%
Czech Republic	316	0.00%	-	-	316	3.50%	-	-
Denmark	896	0.20%	95	2.10%	896	5.00%	95	46.30%
Estonia	51	2.00%	8	0.00%	45	0.00%	4	0.00%
Finland	-	-	769	0.30%	-	-	769	26.10%
France	1 413	0.10%	1 413	0.10%	1 413	25.50%	1 413	25.50%
Germany	347	0.30%	-	-	353	7.40%	-	-
Hungary	139	5.80%	107	8.40%	131	15.30%	107	23.40%
Iceland	32	6.30%	-	-	32	21.90%	-	-
Ireland	324	6.20%	283	5.30%	310	17.70%	282	18.40%
Italy	174	6.30%	71	7.00%	266	27.40%	70	25.70%
Latvia	40	10.00%	-	-	46	0.00%	-	-
Lithuania	48	2.10%	3	0.00%	42	21.40%	3	33.30%
Luxembourg	50	2.00%	-	-	52	15.40%	-	-
Malta	10	10.00%	8	12.50%	8	12.50%	11	27.30%
Netherlands	1 067	0.30%	-	-	1 200	3.80%	-	-
Norway**	619	0.00%	717	0.00%	570	4.00%	717	4.00%
Poland	165	4.20%	190	20.00%	135	26.70%	190	33.70%
Portugal	439	8.40%	-	-	417	14.10%	-	-
Romania	36	61.10%	25	28.00%	18	44.40%	25	64.00%
Slovakia	26	3.80%	26	11.50%	25	12.00%	24	20.80%
Slovenia	252	0.80%	255	11.80%	251	23.10%	255	24.30%
Spain	736	9.80%	2 220	3.90%	747	24.00%	2 220	24.00%
Sweden	1 013	3.20%	-	-	963	4.50%	-	-
United Kingdom	1 324	0.80%	107	7.50%	1 263	5.00%	80	6.30%

** National data analysis allows for a more accurate validation. Due to differences in the validation algorithms used by EARS-Net and Austria, there are small discrepancies in data presented by EARS-Net.*

*** Reported MIC data interpreted to allow inclusion of data in Annex 1 Table A17.*

Annex 2

Table B1. Description of the data sources for surveillance data on invasive *H. influenzae* disease, reporting year 2011

						Data reported by					
Country	**Data source**	**Legal character**	**Comprehensive / sentinel**	**Active / passive**	**Case-based / - aggregated**	**Labs**	**Physicians**	**Hosp.**	**Others**	**Case def.**	**National coverage**
Austria	AT-Epidemiegesetz	Cp	Co	P	C	Y	Y	Y	Y	EU'08	Y
Belgium	BE-LABNET	V	Se	A	C	Y	N	U	U		Y
Bulgaria	BG-NATIONAL_SURVEILLANCE	Cp	Co	P	A	Y	Y	Y	Y	EU'02	Y
Cyprus	CY-LABNET										
Czech Republic	CZ-EPIDAT	Cp	Co	A	C	N	Y	Y	N	EU'08	Y
Denmark	DK-MIS	Cp	Co	P	C	N	Y	N	N	Other	Y
Estonia	EE-HIB	Cp	Co	P	C	Y	Y	Y	Y	EU'02	Y
Finland	FI-NIDR	Cp	Co	P	C	Y	N	N	N	EU'08	Y
France	FR-EPIBAC	V	Se	A	C	Y	N	Y	N	EU'08	Y
Greece	GR-NOTIFIABLE_DISEASES	Cp	Co	P	C	Y	Y	Y	N	Other	Y
Greece	GR-EUIBIS_Historical	Cp	Co	P	C	Y	Y	Y	N		
Hungary	HU-EFRIR	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Iceland	IS-SUBJECT_TO_REGISTRATION	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Ireland	IE-CIDR	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Italy	IT-MENINGITIS	Cp	Co	P	C	N	Y	Y	Y	EU'08	Y
Latvia	LV-BSN	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Lithuania	LT-COMMUNICABLE_DISEASES	Cp	Co	P	C	Y	Y	N	N		Y
Malta	MT-DISEASE_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	Y	EU'08	Y
Netherlands	NL-OSIRIS	Cp	Co	P	C	Y	Y	N	N	EU'08	Y
Netherlands	NL-NRBM	V	Co	P	C	Y	N	N	N	EU'08	Y
Norway	NO-MSIS_A	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Poland	PL-NATIONAL_SURVEILLANCE	Cp	Co	P	C	N	Y	Y	N	EU'08	Y
Portugal	PT-HAEMOPHILUS_INFLUENZAE	Cp	Co	P	C	Y	Y	N	N	EU'08	Y
Romania	RO-RNSSy	Cp	Co	P	C	N	N	Y	N	EU'08	Y
Slovakia	SK-EPIS	Cp	Co	A	C	Y	Y	Y	N	EU'08	Y
Slovenia	SI-SURVIVAL	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Spain	ES-MICROBIOLOGICAL	V	Se	P	C	Y	N	N	N	EU'08	N
Sweden	SE-SMINET	Cp	Co	P	C	Y	Y	N	N	EU'08	Y
United Kingdom	UK-HIB	O	Co	P	C	Y	N	Y	Y	EU'02	

Cp: Compulsory, V: Voluntary, Co: Comprehensive, O: Other, Se: Sentinel, P: Passive, A: Active, C: Case-based, A: Aggregated, Y: Yes, N: No.

Table B2. Population coverage of the FR-EPIBAC data source from France

Age-group (years)	Population covered by surveillance 2011		
	Female	Male	Both
<1	289 992	303 065	593 057
1 to 4	1 139 941	1 189 930	2 329 871
5 to 14	2 818 951	2 957 650	5 776 601
15-24	2 851 593	2 945 889	5 797 482
25-49	7 812 716	7 680 176	15 492 892
50-64	4 740 475	4 474 425	9 214 900
≥65	4 790 599	3 421 240	8 211 840
All ages	24 444 267	22 972 375	47 416 642

Table B3. Quality of 2011 data; distribution of known, unknown, not applicable and blank responses per variable for all reported cases of invasive *H. influenzae* disease by country, in EU/EEA countries (n=2 152*)

Variable	Known		Unknown		Blank		Overall missing
	N	%	N	%	N	%	%
Age**	2 140	99.4	0	0.0	12	0.6	0.6
AgeMonth***	173	96.1	7	3.9	0	0.0	3.9
Classification**	2 152	100.0	0	0.0	0	0.0	0.0
ClinicalPresentation	981	45.6	1 169	54.4	0	0.0	54.4
Gender**	2 133	99.1	19	0.9	0	0.0	0.9
Outcome	1 142	53.1	1 008	46.9	0	0.0	46.9
Serotype	1 062	49.3	1 090	50.7	0	0.0	50.7
Specimen	2 033	94.6	117	5.4	0	0.0	5.4
TestMethod	1 835	85.3	315	14.7	0	0.0	14.7
VaccStatus	274	12.7	1 876	87.3	0	0.0	87.3

** N includes aggregated data that is only considered in the variables Age, Classification and Gender.*
*** Includes case-based and aggregated data.*
**** AgeMonth is reported only for cases aged <2 years.*

Table B4. Distribution of specimens among reported invasive *H. influenzae* disease cases by specimen type and country, EU/EEA countries, 2011 (n=2 034)

Country	Blood		CSF		Other Sterile Site		Total
	N	%	N	%	N	%	N
Austria	0	0.0	1	100.0	0	0.0	1
Cyprus	1	100.0	0	0.0	0	0.0	1
Czech Republic	9	69.2	4	30.8	0	0.0	13
Denmark	37	84.1	7	15.9	0	0.0	44
Estonia	0	0.0	2	100.0	0	0.0	2
Finland	64	97.0	2	3.0	0	0.0	66
France	446	90.7	46	9.3	0	0.0	492
Greece	0	0.0	1	100.0	0	0.0	1
Hungary	0	0.0	8	100.0	0	0.0	8
Ireland	39	88.6	4	9.1	1	2.3	44
Italy	33	70.2	14	29.8	0	0.0	47
Lithuania	0	0.0	2	100.0	0	0.0	2
Netherlands	124	90.5	13	9.5	0	0.0	137
Poland	10	55.6	8	44.4	0	0.0	18
Portugal	19	86.4	3	13.6	0	0.0	22
Romania	0	0.0	10	100.0	0	0.0	10
Slovenia	20	90.9	2	9.1	0	0.0	22
Spain	67	87.0	6	7.8	4	5.2	77
Sweden	186	91.6	7	3.4	10	4.9	203
United Kingdom	618	83.9	15	2.0	104	14.1	737
EU Total	**1 673**	**85.9**	**155**	**8.0**	**119**	**6.1**	**1 947**
Iceland	2	100.0	0	0.0	0	0.0	2
Norway	81	95.3	3	3.5	1	1.2	85
EU/EEA total	**1 756**	**86.3**	**158**	**7.8**	**120**	**5.9**	**2 034**

** CSF = Cerebrospinal fluid*

Table B5. Distribution of specimens among reported invasive *H. influenzae* disease cases by specimen type and age* group, EU/EEA countries, 2011 (n=2 024)

Specimen	<1 year		1-4 years		5-14 years		15-64 years		≥65 years		Total
	N	%	N	%	N	%	N	%	N	%	
Blood	103	77.4	69	65.7	45	83.3	622	82.3	908	93.0	1 747
CSF**	22	16.5	26	24.8	4	7.4	73	9.7	32	3.3	157
Other sterile site	8	6.0	10	9.5	5	9.3	61	8.1	36	3.7	120
Total	133		105		54		756		976		2 024

** 10 cases with missing age*

*** CSF = Cerebrospinal fluid.*

Table B6. Distribution by month of reported invasive *H. influenzae* disease cases by country, EU/EEA countries, 2011 (n=2 152)

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Austria	0	0	1	0	1	0	0	1	0	0	0	0
Belgium	11	6	10	11	11	7	8	7	3	7	3	12
Bulgaria	1	0	0	1	0	0	0	0	0	0	0	0
Cyprus	0	0	0	1	0	0	0	0	0	0	0	0
Czech Republic	1	1	2	2	1	0	0	0	0	0	3	5
Denmark	8	4	4	5	3	2	3	0	5	2	2	9
Estonia	0	0	1	1	0	0	0	0	0	0	0	0
Finland	4	3	4	3	3	5	6	3	8	7	10	10
France	66	43	76	46	37	31	23	25	29	32	37	47
Greece	0	0	0	0	0	0	1	0	0	0	0	0
Hungary	0	1	0	2	0	1	1	0	1	0	0	2
Iceland	0	1	0	0	0	0	0	0	0	1	0	0
Ireland	5	2	4	5	7	4	1	3	3	5	4	1
Italy	3	6	7	3	6	2	3	1	1	5	5	5
Lithuania	1	0	0	0	0	0	1	0	0	0	0	0
Netherlands	18	14	13	19	9	6	8	7	5	9	14	15
Norway	14	5	5	8	7	5	2	10	10	8	4	7
Poland	1	2	4	2	2	2	3	1	2	1	1	1
Portugal	3	4	1	4	2	0	1	0	1	1	3	2
Romania	0	1	1	0	1	3	1	0	0	0	1	2
Slovenia	3	3	4	2	2	1	2	1	0	3	1	0
Spain	11	13	12	4	6	6	9	1	2	1	6	6
Sweden	13	11	13	17	16	13	16	19	18	20	27	20
United Kingdom	105	65	82	80	50	52	48	38	41	52	47	86
Total	**268**	**185**	**244**	**216**	**164**	**140**	**137**	**117**	**129**	**154**	**168**	**230**

Table B7. Distribution by age group of reported invasive *H. influenzae* disease cases by country, EU/EEA countries, 2011 (n=2 138)

Country	<1 year		1-4 years		5-14 years		15-24 years		25-49 years		50-64 years		≥65 years		Total
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Austria	1	33.3	1	33.3	0	0.0	0	0.0	0	0.0	0	0.0	1	33.3	3
Belgium	5	5.4	2	2.2	3	3.2	3	3.2	12	12.9	20	21.5	48	51.6	93
Bulgaria*															
Cyprus	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0	0	0.0	0	0.0	1
Czech Republic	1	6.7	1	6.7	0	0.0	1	6.7	2	13.3	3	20.0	7	46.7	15
Denmark	1	2.1	4	8.5	1	2.1	1	2.1	6	12.8	6	12.8	28	59.6	47
Estonia	0	0.0	1	50.0	0	0.0	1	50.0	0	0.0	0	0.0	0	0.0	2
Finland	0	0.0	4	6.1	1	1.5	3	4.5	9	13.6	12	18.2	37	56.1	66
France	22	4.5	20	4.1	12	2.4	13	2.6	84	17.1	91	18.5	250	50.8	492
Greece	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1
Hungary	0	0.0	1	12.5	1	12.5	0	0.0	2	25.0	1	12.5	3	37.5	8
Ireland	4	9.1	4	9.1	2	4.5	1	2.3	8	18.2	5	11.4	20	45.5	44
Italy	3	6.4	2	4.3	2	4.3	2	4.3	8	17.0	8	17.0	22	46.8	47
Lithuania	2	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2
Netherlands	12	8.8	8	5.8	4	2.9	5	3.6	21	15.3	29	21.2	58	42.3	137
Poland	5	22.7	2	9.1	2	9.1	1	4.5	2	9.1	5	22.7	5	22.7	22
Portugal	4	18.2	3	13.6	2	9.1	0	0.0	3	13.6	2	9.1	8	36.4	22
Romania	0	0.0	9	90.0	0	0.0	0	0.0	1	10.0	0	0.0	0	0.0	10
Slovenia	2	9.1	1	4.5	1	4.5	0	0.0	2	9.1	4	18.2	12	54.5	22
Spain	0	0.0	3	4.3	3	4.3	0	0.0	9	13.0	13	18.8	41	59.4	69
Sweden	2	1.0	5	2.5	3	1.5	2	1.0	26	12.8	44	21.7	121	59.6	203
United Kingdom	72	9.7	35	4.7	19	2.6	32	4.3	124	16.6	128	17.2	335	45.0	745
EU total	**137**	**6.7**	**106**	**5.2**	**56**	**2.7**	**65**	**3.2**	**320**	**15.6**	**371**	**18.1**	**996**	**48.6**	**2051**
Iceland	0	0.0	0	0.0	0	0.0	0	0.0	1	50.0	0	0.0	1	50.0	2
Norway	2	2.4	3	3.5	3	3.5	3	3.5	14	16.5	25	29.4	35	41.2	85
EU/EEA total	**139**	**6.5**	**109**	**5.1**	**59**	**2.8**	**68**	**3.2**	**335**	**15.7**	**396**	**18.5**	**1032**	**48.3**	**2138**

** Aggregated data reported, exact number of cases in these age groups could not be determined.*

Table B8. Notification rate of reported invasive *H. influenzae* disease cases by age group, EU/EEA countries, 2008-11 (n=7 491)

Age group	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
< 1 year	145	3.7	154	3.9	132	3.3	134	3.4
1-4 years	108	0.7	139	0.9	96	0.6	107	0.7
5-14 years	75	0.2	62	0.2	47	0.1	56	0.1
15-64 years	671	0.3	648	0.3	625	0.3	762	0.3
≥65 years	855	1.4	832	1.4	860	1.4	983	1.6

Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom.

Table B9. Distribution of reported invasive *H. influenzae* disease cases by clinical presentation and country, EU/EEA countries, 2011 (n=702*)

Country	Septicaemia		Meningitis		Pneumonia		Other		Meningitis/ septicaemia		Cellulitis		Osteomyelitis /septic arthritis		Total
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Austria	0	0.0	3	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3
Cyprus	0	0.0	0	0.0	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0	1
Czech Republic	6	40.0	4	26.7	5	33.3	0	0.0	0	0.0	0	0.0	0	0.0	15
Estonia	0	0.0	2	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2
France	43	34.7	46	37.1	25	20.2	8	6.5	0	0.0	0	0.0	2	1.6	124
Greece	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0	0	0.0	0	0.0	1
Hungary	0	0.0	8	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	8
Ireland	11	35.5	3	9.7	12	38.7	3	9.7	1	3.2	1	3.2	0	0.0	31
Italy	25	53.2	15	31.9	6	12.8	0	0.0	1	2.1	0	0.0	0	0.0	47
Lithuania	1	50.0	1	50.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2
Poland	9	40.9	8	36.4	0	0.0	5	22.7	0	0.0	0	0.0	0	0.0	22
Portugal	13	59.1	2	9.1	6	27.3	0	0.0	0	0.0	1	4.5	0	0.0	22
Slovenia	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1
United Kingdom	324	90.3	21	5.8	6	1.7	8	2.2	0	0.0	0	0.0	0	0.0	359
EU total	**433**	**67.9**	**113**	**17.7**	**61**	**9.6**	**24**	**3.8**	**3**	**0.5**	**2**	**0.3**	**2**	**0.3**	**638**
Norway	18	28.1	5	7.8	16	25.0	25	39.1	0	0.0	0	0.0	0	0.0	64
EU/EEA total	**451**	**64.2**	**118**	**16.8**	**77**	**11.0**	**49**	**7.0**	**3**	**0.4**	**2**	**0.3**	**2**	**0.3**	**702**

** Excludes cases reported as NUS (Not Under Surveillance).*

Table B10. Case–fatality rate due to invasive *H. influenzae* disease in EU/EEA countries*, 2011 (n=1 142)

Country	No. of cases	No. of cases with known outcome	No. of deaths	CFR (%)	95% Confidence interval (%)
Austria	3	3	0	0.0	0.0 - 70.1
Cyprus	1	1	0	0.0	0.0 - 97.5
Czech Republic	15	15	3	20.0	4.3 - 48.1
Denmark	47	6	0	0.0	0.0 - 45.9
Estonia	2	2	0	0.0	0.0 - 84.2
France	492	46	4	8.7	2.4 - 20.8
Hungary	8	8	1	12.5	0.3 - 52.7
Ireland	44	23	4	17.4	5.0 - 38.8
Italy	47	33	8	24.2	11.1 - 42.3
Lithuania	2	2	0	0.0	0.0 - 84.2
Norway	85	58	6	10.3	3.9 - 21.2
Poland	22	22	4	18.2	5.2 - 40.3
Portugal	22	1	0	0.0	0.0 - 97.5
Romania	10	10	0	0.0	0.0 - 30.8
Slovenia	22	22	2	9.1	1.1 - 29.2
Sweden	203	203	26	12.8	8.5 - 18.2
United Kingdom	746	687	68	9.9	7.8 - 12.4
Total	**1 771**	**1 142**	**126**	**11.0**	**9.3 - 13.0**

** Only 'unknown' outcomes reported by Belgium, Finland, Greece, Iceland, Netherlands and Spain*

Table B11. Number of cases, total number of deaths and case–fatality rate due to invasive *H. influenzae* disease by clinical presentation in EU/EEA countries*, 2011

Clinical presentation	Deaths	Number of cases	CFR
Septicaemia	49	402	12.2%
Meningitis	8	64	12.5%
Pneumonia	5	53	9.4%
Other**	6	48	12.5%
Total	**68**	**567**	**12.0%**

** Excludes cases reported as NUS (Not Under Surveillance).*

*** 'Other' includes cases where clinical presentation was recorded as other, meningitis/septicaemia, cellulitis or osteomyelitits/septic arthritis due to the number of reported cases of the latter three being very low.*

Table B12. Number of cases, total number of deaths and case–fatality rate due to invasive *H. influenzae* disease by age group in EU/EEA countries, 2011 (n=1 141)

Age group	Deaths	Number of cases	CFR
<1year	17	87	19.5%
1-4 years	4	62	6.5%
5-14 years	2	35	5.7%
15-64 years	23	424	5.4%
≥65 years	80	533	15.0%
Total	**126**	**1 141**	**11.0%**

Table B13. Distribution of reported invasive *H. influenzae* disease cases by serotype and country, EU/EEA countries, 2011 (n=1 062)

Country	non-caps		non-b		b		Total
	N	%	N	%	N	%	N
Austria	0	0.0	0	0.0	1	100.0	1
Cyprus	0	0.0	0	0.0	1	100.0	1
Czech Republic	9	81.8	2	18.2	0	0.0	11
Denmark	35	74.5	9	19.1	3	6.4	47
Estonia	0	0.0	0	0.0	2	100.0	2
Finland	57	87.7	4	6.2	4	6.2	65
France	66	84.6	10	12.8	2	2.6	78
Greece	0	0.0	0	0.0	1	100.0	1
Hungary	0	0.0	6	100.0	0	0.0	6
Ireland	34	82.9	4	9.8	3	7.3	41
Italy	22	78.6	6	21.4	0	0.0	28
Netherlands	0	0.0	16	42.1	22	57.9	38
Poland	10	62.5	2	12.5	4	25.0	16
Portugal	18	81.8	4	18.2	0	0.0	22
Romania	0	0.0	0	0.0	1	100.0	1
Slovenia	22	100.0	0	0.0	0	0.0	22
Spain	0	0.0	0	0.0	2	100.0	2
Sweden	46	66.7	20	29.0	3	4.3	69
United Kingdom	438	82.2	71	13.3	24	4.5	533
EU total	**757**	**76.9**	**154**	**15.7**	**73**	**7.4**	**984**
Norway	58	74.4	18	23.1	2	2.6	78
EU/EEA total	**815**	**76.7**	**172**	**16.2**	**75**	**7.1**	**1062**

** Non-b includes serotypes A, C, D, E, F and isolates classed as 'non-b'*

Table B14. Notification rates of invasive *H. influenzae* disease in EU and EEA countries, by serotype and year, 2008-11 (n=7 512)

Serotype	2008	2009	2010	2011
non-caps	0.16	0.18	0.18	0.25
non-b	0.05	0.05	0.05	0.05
b	0.05	0.04	0.04	0.02
Unknown	0.31	0.30	0.27	0.30

Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom.

Table B15. Distribution of invasive *H. influenzae* disease serotypes by age group, EU/EEA countries, 2011 (n=1 057*)

Serotype	<1 year		1-4 years		5-14 years		15-64 years		≥65 years	
	N	%	N	%	N	%	N	%	N	%
non-caps	64	79.0	41	69.5	24	66.7	284	75.5	401	79.4
non-b	4	4.9	10	16.9	6	16.7	61	16.2	87	17.2
B	13	16.0	8	13.6	6	16.7	31	8.2	17	3.4
Total cases	81		59		36		376		505	

Total cases = total number of cases for which serotype information is available by age group

** Overall 5 missing cases for age group among all serotypes: serotype non-caps (n missing=1), and non-b (n=4).*

Table B16. Distribution of invasive *H. influenzae* disease serotypes by gender, EU/EEA countries, 2011 (n=1 048*)

Serotype	Male		Female		UNK
	N	%	N	%	N
non-caps	393	79.7	413	74.4	8
non-b	68	13.8	99	17.8	1
b	32	6.5	43	7.7	0
Total	493		555		

** Overall 14 missing cases for gender among all serotypes: serotype non-caps (n missing=9), and non-b (n=5)*

*** Non-b includes serotypes A, C, D, E, F and isolates classed as 'non-b'*

Table B17. Notification rate of invasive *H. influenzae* serotype b disease, by age group and year of reporting, EU/EEA, 2008–11 (n=477)

Age group	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
< 1 year	24	0.66	20	0.55	17	0.47	12	0.33
1-4 years	26	0.18	17	0.12	17	0.12	7	0.05
5-14 years	20	0.06	5	0.01	5	0.01	6	0.02
15-64 years	64	0.03	53	0.02	52	0.02	25	0.01
≥65 years	33	0.06	23	0.04	34	0.06	17	0.03

Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom.

Table B18. Notification rate of invasive *H. influenzae* non-b disease, by age group and year of reporting, EU/EEA, 2008–11 (n=610)

Age group	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
< 1 year	14	0.38	14	0.38	8	0.22	4	0.11
1-4 years	11	0.08	11	0.08	11	0.08	9	0.06
5-14 years	7	0.02	10	0.03	1	0.00	5	0.01
15-64 years	62	0.03	51	0.02	53	0.02	58	0.03
≥65 years	63	0.12	67	0.12	69	0.13	82	0.15

Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom

Table B19. Notification rate of invasive *H. influenzae* non-caps disease, by age group and year of reporting, EU/EEA, 2008–11 (n=2 368)

Age group	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
< 1 year	54	1.48	59	1.62	46	1.26	59	1.62
1-4 years	28	0.19	47	0.33	29	0.20	35	0.24
5-14 years	11	0.03	14	0.04	20	0.06	18	0.05
15-64 years	166	0.08	182	0.08	182	0.08	258	0.12
≥65 years	248	0.45	283	0.52	268	0.49	361	0.66

Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom.

Annex 3

Table C1. Description of the data sources for surveillance data on IMD, reporting year 2011

Country	Data source	Legal character	Comprehensive / sentinel	Active / passive	Case-based / aggregated	Data reported by				Case def.	National coverage
						Labs	Physicians	Hosp.	Others		
Austria	AT-Epidemiegesetz	Cp	Co	P	C	Y	Y	Y	Y	EU'08	Y
Belgium	BE-REFLAB	Cp	Co	P	C	Y	Y	Y	Y	EU'08	Y
Bulgaria	BG-NATIONAL_SURVEILLANCE	Cp	Co	P	A	Y	Y	Y	Y	EU'08	Y
Cyprus	CY-LABNET	V	Se	A	C	Y	N	N	N	none	N
Czech Republic	CZ-EPIDAT	Cp	Co	A	C	N	Y	Y	N	EU'08	Y
Denmark	DK-MIS	Cp	Co	P	C	N	Y	N	N	Other	Y
Estonia	EE-MENINGOCOCC	Cp	Co	P	C	Y	Y	Y	Y	EU'02	Y
Finland	FI-NIDR	Cp	Co	P	C	Y	Y	N	N	Other	Y
France	FR-MANDATORY_INFECTIOUS_DISEASES	Cp	Co	P	C	Y	Y	Y	Y	EU'08	Y
Germany	DE-SURVNET@RKI-7.1/6	Cp	Co	P	C	Y	Y	Y	Y	Other	Y
Greece	GR-NOTIFIABLE_DISEASES	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Hungary	HU-EFRIR	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Iceland	IS-SUBJECT_TO_REGISTRATION	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Ireland	IE-CIDR	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Italy	IT-MENINGITIS	Cp	Co	P	C	N	Y	Y	N	EU'08	Y
Latvia	LV-BSN	Cp	Co	P	C	Y	Y	Y	N	EUCD	Y
Lithuania	LT-COMMUNICABLE_DISEASES	Cp	Co	P	C	Y	Y	N	N		Y
Luxembourg	LU-SYSTEM1	Cp	Co	P	C	Y	Y	N	N	none	Y
Malta	MT-DISEASE_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	Y	EU'08	Y
Netherlands	NL-OSIRIS	Cp	Co	P	C	Y	Y	N	N	EU'08	Y
Netherlands	NL-NRBM	V	Co	P	C	Y	N	N	N	EU'08	Y
Norway	NO-MSIS_A	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Poland	PL-NATIONAL_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Portugal	PT-MENINGOCOCAL	Cp	Co	P	C	Y	Y	N	N	EU'08	Y
Romania	RO-RNSSy	Cp	Co	P	C	N	N	Y	N	EU'08	Y
Slovakia	SK-EPIS	Cp	Co	A	C	Y	Y	Y	N	EU'08	Y
Slovenia	SI-SURVIVAL	Cp	Co	P	C	Y	Y	Y	N	EU'08	Y
Spain	ES-STATUTORY_DISEASES	Cp	Co	P	C	N	Y	Y	N	EU'08	Y
Spain	ES-NRL	V	Se	P	C	Y	N	N	N	EU'08	Y
Sweden	SE-SMINET	Cp	Co	P	C	Y	Y	N	N	EU'08	Y
United Kingdom	UK-MENINGOCOCCAL	O	Co	P	C	Y	N	Y	Y	Other	Y

Cp: Compulsory, V: Voluntary, Co: Comprehensive, O: Other, Se: Sentinel, P: Passive, A: Active, C: Case-based, A: Aggregated, Y: Yes, N: No

Table C2. Quality of 2011 data; distribution of known, unknown, not applicable and blank responses per variable for all reported cases of IMD by country, in EU/EEA countries (n=4 114*)

Variable	Known		Unknown		Blank		Overall missing
	N	%	N	%	N	%	
Age	4 105	99.8	0	0.0	9	0.2	0.2
AgeMonth*	1 079	96.9	35	3.1	0	0.0	3.1
Classification	4 114	100.0	0	0.0	0	0.0	0.0
ClinicalPresentation	2 083	50.9	2 013	49.1	0	0.0	49.1
Gender	4 097	99.6	17	0.4	0	0.0	0.4
Outcome	3 405	83.1	691	16.9	0	0.0	16.9
Serogroup	3 766	91.9	330	8.1	0	0.0	8.1
Specimen	2 936	71.7	1 160	28.3	0	0.0	28.3
ResultFetVR	2 627	64.1	1 469	35.9	0	0.0	35.9
ResultMLST1	944	23.0	3 152	77.0	0	0.0	77.0
ResultPorA1	2 683	65.5	1 413	34.5	0	0.0	34.5
ResultPorA2	2 696	65.8	1 400	34.2	0	0.0	34.2
MIC_CIP	974	23.8	3 122	76.2	0	0.0	76.2
MIC_CTX	1 330	32.5	2 766	67.5	0	0.0	67.5
MIC_PEN	1 560	38.1	2 536	61.9	0	0.0	61.9
MIC_RIF	1 325	32.3	2 771	67.7	0	0.0	67.7
ProbableCountryOfInfection	160	87.0	24	13.0	0	0.0	13.0
TestMethod	3 283	80.2	813	19.8	0	0.0	19.8
VaccStatus	1 082	26.4	3 014	73.6	0	0.0	73.6

** N includes aggregated data that is only considered in the variables Age, Classification and Gender. Also, data from ES-STATUTORY_DISEASES and ES-NRL is included for Spain. The data presented in 'Results' differ from the data presented in Table NM1 as in the 'Results' only one of these data sources is considered for each individual variable.*

*** Includes case-based and aggregated data.*

**** AgeMonth is reported only for cases aged <2 years.*

Table C3. Distribution of specimens among reported IMD cases by specimen type and country, EU/EEA countries, 2011 (n=2 905)

Country	Blood		CSF		Other Sterile Site		Skin		Total
	N	%	N	%	N	%	N	%	N
Austria	13	39.4	18	54.5	2	6.1	0	0.0	33
Cyprus	0	0.0	1	100.0	0	0.0	0	0.0	1
Czech Republic	14	22.2	43	68.3	6	9.5	0	0.0	63
Denmark	33	45.8	36	50.0	3	4.2	0	0.0	72
Estonia	2	28.6	5	71.4	0	0.0	0	0.0	7
Finland	26	76.5	8	23.5	0	0.0	0	0.0	34
France	171	33.7	287	56.5	50	9.8	0	0.0	508
Germany	182	54.0	154	45.7	1	0.3	0	0.0	337
Greece	7	13.7	44	86.3	0	0.0	0	0.0	51
Hungary	12	17.9	50	74.6	5	7.5	0	0.0	67
Ireland	79	88.8	10	11.2	0	0.0	0	0.0	89
Italy	63	41.4	89	58.6	0	0.0	0	0.0	152
Latvia	0	0.0	2	100.0	0	0.0	0	0.0	2
Lithuania	42	100.0	0	0.0	0	0.0	0	0.0	42
Lithuania	0	0.0	2	100.0	0	0.0	0	0.0	2
Malta	5	83.3	1	16.7	0	0.0	0	0.0	6
Netherlands	50	58.8	35	41.2	0	0.0	0	0.0	85
Poland	129	45.7	152	53.9	1	0.4	0	0.0	282
Portugal	34	50.0	34	50.0	0	0.0	0	0.0	68
Romania	4	5.9	64	94.1	0	0.0	0	0.0	68
Slovakia	10	47.6	8	38.1	3	14.3	0	0.0	21
Slovenia	7	53.8	6	46.2	0	0.0	0	0.0	13
Spain	156	53.1	135	45.9	2	0.7	1	0.3	294
Sweden	45	67.2	21	31.3	1	1.5	0	0.0	67
United Kingdom	446	88.8	55	11.0	0	0.0	1	0.2	502
EU total	**1 530**	**53.4**	**1 260**	**44.0**	**74**	**2.6**	**2**	**0.1**	**2 866**
Iceland	1	50.0	1	50.0	0	0.0	0	0.0	2
Norway	28	75.7	8	21.6	1	2.7	0	0.0	37
EU/EEA total	**1 559**	**53.7**	**1 269**	**43.7**	**75**	**2.6**	**2**	**0.1**	**2 905**

** CSF = Cerebrospinal fluid*
*** Skin = Skin biopsy or aspirate of purpura/petechiae*

Table C4. Distribution of specimens among reported IMD cases by specimen type and age group*, EU/EEA countries, 2011 (n=2 900)

Specimen	<1 year		1-4 years		5-14 years		15-64 years		≥65 years		Total
	N	%	N	%	N	%	N	%	N	%	
Blood	278	54.9	353	55.8	163	51.1	540	47.2	221	74.4	1 555
CSF**	219	43.3	251	39.7	150	47.0	576	50.3	72	24.2	1 268
Other Sterile Site	9	1.8	29	4.6	5	1.6	28	2.4	4	1.3	75
Skin***	0	0.0	0	0.0	1	0.3	1	0.1	0	0.0	2
Total	506		633		319		1145		297		2 900

** Seven cases with missing age.*
*** CSF = Cerebrospinal fluid.*
**** Skin = Skin biopsy or aspirate of purpura/petechiae*

Table C5. Distribution by month of reported IMD cases by country, EU/EEA countries, 2011 (n=3 793*)

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Austria	3	9	11	4	1	2	3	2	2	4	6	2
Belgium	18	13	16	9	14	5	7	4	2	6	8	9
Cyprus	0	0	0	1	0	0	0	0	0	0	0	0
Czech Republic	8	10	5	3	3	8	2	2	1	8	10	3
Denmark	7	9	7	10	6	5	6	1	5	6	3	7
Estonia	0	1	1	0	1	2	1	0	0	0	1	0
Finland	3	5	3	1	2	3	4	3	5	3	2	0
France	83	62	55	41	34	33	42	29	32	50	52	50
Germany	68	40	42	31	21	23	13	22	23	30	30	20
Greece	7	4	6	6	3	6	6	1	1	5	4	2
Hungary	8	12	13	3	3	3	2	0	3	4	4	12
Iceland	2	0	0	0	0	0	0	0	0	0	0	0
Ireland	21	7	7	8	9	4	6	3	3	9	11	1
Italy	17	19	19	16	12	9	9	7	12	7	10	15
Latvia	0	0	0	0	1	0	0	0	0	0	0	1
Lithuania	4	4	6	6	5	3	0	0	1	3	5	5
Malta	0	0	0	0	0	0	1	3	1	0	1	0
Netherlands	11	12	4	8	8	5	4	6	6	7	8	6
Norway	3	2	5	2	6	2	3	2	2	5	2	3
Poland	26	34	36	26	25	22	17	13	17	20	18	28
Portugal	10	11	1	10	5	7	7	5	5	5	2	10
Romania	4	9	9	4	12	7	5	3	3	5	2	5
Slovakia	0	5	5	2	2	1	0	0	1	1	0	4
Slovenia	2	2	0	0	2	2	0	0	1	0	2	2
Spain	69	53	54	37	29	21	26	23	24	25	30	40
Sweden	9	9	5	4	6	8	6	2	7	3	4	5
United Kingdom	265	84	116	87	64	58	51	54	44	65	77	71
Total	**648**	**416**	**426**	**319**	**274**	**239**	**221**	**185**	**201**	**271**	**292**	**301**

**Number of cases by month was not reported by Luxembourg (two cases). For Bulgaria (13 cases), as the data was aggregated, the number of cases by month could not be determined for only confirmed cases.*

Table C6. Distribution by age group of reported IMD cases by country, EU/EEA countries, 2011 (n=3 782)

Country	<1yr		1-4 years		5-14 years		15-24 years		25-49 years		50-64 years		≥65 years		Total
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Austria	5	10.2	5	10.2	10	20.4	16	32.7	2	4.1	7	14.3	4	8.2	49
Belgium	16	14.5	24	21.8	10	9.1	23	20.9	11	10.0	8	7.3	18	16.4	110
Bulgaria															
Cyprus	0	0.0	0	0.0	0	0.0	1	100.0	0	0.0	0	0.0	0	0.0	1
Czech Republic	12	19.0	13	20.6	5	7.9	16	25.4	9	14.3	4	6.3	4	6.3	63
Denmark	8	11.1	14	19.4	6	8.3	17	23.6	9	12.5	9	12.5	9	12.5	72
Estonia	2	28.6	1	14.3	0	0.0	3	42.9	0	0.0	1	14.3	0	0.0	7
Finland	2	5.9	3	8.8	2	5.9	13	38.2	5	14.7	3	8.8	6	17.6	34
France	87	15.5	113	20.1	59	10.5	149	26.5	64	11.4	39	6.9	52	9.2	563
Germany	51	14.1	63	17.4	30	8.3	107	29.6	49	13.5	19	5.2	43	11.9	362
Greece	6	11.8	10	19.6	12	23.5	13	25.5	6	11.8	3	5.9	1	2.0	51
Hungary	9	13.4	12	17.9	6	9.0	19	28.4	12	17.9	4	6.0	5	7.5	67
Ireland	29	32.6	27	30.3	12	13.5	9	10.1	6	6.7	3	3.4	3	3.4	89
Italy	18	11.8	23	15.1	30	19.7	32	21.1	22	14.5	14	9.2	13	8.6	152
Latvia	1	50.0	1	50.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2
Lithuania	3	7.1	8	19.0	3	7.1	18	42.9	5	11.9	3	7.1	2	4.8	42
Luxembourg	1	50.0	0	0.0	0	0.0	1	50.0	0	0.0	0	0.0	0	0.0	2
Malta	0	0.0	0	0.0	0	0.0	3	50.0	1	16.7	0	0.0	2	33.3	6
Netherlands	14	16.5	21	24.7	5	5.9	20	23.5	8	9.4	9	10.6	8	9.4	85
Poland	54	19.1	78	27.7	35	12.4	59	20.9	29	10.3	18	6.4	9	3.2	282
Portugal	21	28.4	17	23.0	13	17.6	10	13.5	4	5.4	4	5.4	5	6.8	74
Romania	8	11.8	24	35.3	15	22.1	8	11.8	2	2.9	6	8.8	5	7.4	68
Slovakia	5	23.8	8	38.1	0	0.0	3	14.3	3	14.3	1	4.8	1	4.8	21
Slovenia	1	7.7	3	23.1	1	7.7	6	46.2	1	7.7	0	0.0	1	7.7	13
Spain	73	17.2	100	23.6	65	15.3	47	11.1	60	14.2	30	7.1	49	11.6	424
Sweden	5	7.4	8	11.8	5	7.4	19	27.9	8	11.8	7	10.3	16	23.5	68
United Kingdom	223	21.5	293	28.3	108	10.4	149	14.4	89	8.6	77	7.4	97	9.4	1036
EU total	**654**	**17.5**	**869**	**23.2**	**432**	**11.5**	**761**	**20.3**	**405**	**10.8**	**269**	**7.2**	**353**	**9.4**	**3 743**
Iceland	0	0.0	1	50.0	0	0.0	0	0.0	1	50.0	0	0.0	0	0.0	2
Norway	3	8.1	6	16.2	2	5.4	7	18.9	8	21.6	3	8.1	8	21.6	37
EU/EEA total	**657**	**17.4**	**876**	**23.2**	**434**	**11.5**	**768**	**20.3**	**414**	**10.9**	**272**	**7.2**	**361**	**9.5**	**3 782**

** Aggregated data reported, exact number of cases in these age groups could not be determined*

Table C7. Notification rate of reported IMD cases by age group, EU/EEA countries, 2008 - 2011 (n=16 551)

Age group	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
<1 year	1,104	20.7	988	18.5	686	12.8	657	12.3
1-4 years	961	4.5	917	4.3	876	4.1	870	4.1
5-14 years	576	1.1	606	1.2	412	0.8	434	0.8
15-24 years	915	1.5	875	1.5	730	1.2	767	1.3
25-49 years	506	0.3	450	0.3	401	0.2	414	0.2
50-64 years	297	0.3	281	0.3	262	0.3	272	0.3
≥65 years	327	0.4	318	0.4	288	0.3	361	0.4

Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Table C8. Notification rate of reported IMD cases by age group and gender, EU/EEA countries, 2011 (n=3 769*)

Age group	Male	Female
<1 year	14.0	10.4
1-4 years	4.4	3.8
5-14 years	0.9	0.7
15-24 years	1.3	1.2
25-49 years	0.2	0.2
50-64 years	0.2	0.3
≥65 years	0.3	0.5

** Excludes 16 unknowns, data from Cyprus for which rates of population coverage were unknown, and aggregated data where different age groups were reported.*

Table C9. Distribution of reported IMD cases by clinical presentation and country, EU/EEA countries, 2011 (n=1 824*)

Country	Septicaemia		Meningitis		Meningitis/ septicaemia		Other		Total
	N	%	N	%	N	%	N	%	N
Austria	6	12.8	17	36.2	17	36.2	7	14.9	47
Cyprus	0	0.0	1	100.0	0	0.0	0	0.0	1
Denmark	11	15.5	31	43.7	16	22.5	13	18.3	71
Estonia	2	28.6	4	57.1	1	14.3	0	0.0	7
Germany	104	28.7	162	44.8	32	8.8	64	17.7	362
Greece	3	5.9	25	49.0	23	45.1	0	0.0	51
Hungary	11	16.4	31	46.3	25	37.3	0	0.0	67
Ireland	31	39.2	18	22.8	30	38.0	0	0.0	79
Italy	43	28.3	80	52.6	29	19.1	0	0.0	152
Latvia	0	0.0	2	100.0	0	0.0	0	0.0	2
Lithuania	16	55.2	13	44.8	0	0.0	0	0.0	29
Luxembourg	0	0.0	2	100.0	0	0.0	0	0.0	2
Malta	4	66.7	1	16.7	1	16.7	0	0.0	6
Poland	106	38.0	109	39.1	60	21.5	4	1.4	279
Portugal	15	23.8	39	61.9	9	14.3	0	0.0	63
Romania	6	8.8	60	88.2	2	2.9	0	0.0	68
Slovakia	9	42.9	11	52.4	0	0.0	1	4.8	21
Slovenia	3	50.0	2	33.3	1	16.7	0	0.0	6
Spain	202	49.3	136	33.2	64	15.6	8	2.0	410
United Kingdom	25	36.8	20	29.4	21	30.9	2	2.9	68
EU total	**597**	**33.3**	**764**	**42.7**	**331**	**18.5**	**99**	**5.5**	**1 791**
Norway	7	21.2	13	39.4	3	9.1	10	30.3	33
EU/EEA total	**604**	**33.1**	**777**	**42.6**	**334**	**18.3**	**109**	**6.0**	**1 824**

** Excludes cases reported as NUS (Not Under Surveillance).*

Table C10. Case–fatality rate due to IMD in EU/EEA countries*, 2011 (n=3 392)

Country	No. of cases	No. of cases with known outcome	No. of deaths	CFR (%)	95% Confidence interval (%)
Austria	49	49	7	14.3	6.0-27.2
Cyprus	1	1	0	0.0	0.0-97.5
Czech Republic	63	63	8	12.7	5.6-23.5
Denmark	72	47	8	17.0	7.6-30.8
Estonia	7	7	0	0.0	0.0-41.0
France	563	552	53	9.6	7.3-12.4
Germany	363	362	30	8.3	5.7-11.6
Greece	51	46	0	0.0	0.0-7.7
Hungary	67	67	12	17.9	9.6-29.2
Ireland	89	70	2	2.9	0.3-9.9
Italy	152	115	11	9.6	4.9-16.5
Latvia	2	2	0	0.0	0.0-84.2
Lithuania	42	38	4	10.5	2.9 - 24.8
Luxembourg	2	2	1	50.0	1.3 - 98.7
Malta	6	6	1	16.7	0.4 - 64.1
Norway	37	28	4	14.3	4.0 - 32.7
Poland	282	282	21	7.4	4.7 - 11.2
Portugal	78	64	7	10.9	4.5 - 21.2
Romania	68	68	9	13.2	6.2 - 23.6
Slovakia	21	20	8	40.0	19.1 - 63.9
Slovenia	13	13	1	7.7	0.2 - 36.0
Spain	431	428	58	13.6	10.5 - 17.2
Sweden	68	68	1	1.5	0.0 - 7.9
United Kingdom	1 036	994	48	4.8	3.6 - 6.4
Total	**3 563**	**3 392**	**294**	**8.7**	**7.7-9.6**

** Only 'unknown' outcomes reported by Belgium, Finland, Iceland and Netherlands*

Table C11. Number of cases, total number of deaths and case–fatality rate due to IMD by clinical presentation in EU/EEA countries*, 2011

Clinical presentation	Deaths	Number of cases	CFR
Septicaemia	108	583	18.5%
Meningitis	44	722	6.1%
Meningitis/septicaemia	23	317	7.3%
Other	8	106	7.5%
Total	**183**	**1 728**	**10.6%**

** Excludes cases reported as NUS (Not Under Surveillance).*

Table C12. Number of cases, total number of deaths and case–fatality rate due to IMD by age group in EU/EEA countries, 2011 (n=3 384)

Age group	Deaths	Number of cases	CFR
< 1 year	46	591	7.8%
1-4 years	55	792	6.9%
5-14 years	22	393	5.6%
15-24 years	65	683	9.5%
25-49 years	33	372	8.9%
50-64 years	18	238	7.6%
≥65 years	54	315	17.1%
Total	**293**	**3 384**	**8.7 %**

Table C13. Total number of reported IMD cases by serogroup and by country, 2011

Country	Serogroup								
	A	B	C	NGA	W135	Y	O	Unk	Total
Austria	0	15	8	2	1	2	0	21	49
Belgium	0	84	15	0	1	9	0	2	111
Cyprus	0	1	0	0	0	0	0	0	1
Czech Republic	0	34	2	0	2	2	0	23	63
Denmark	0	27	39	0	1	5	0	0	72
Estonia	0	5	1	0	0	0	0	1	7
Finland	0	19	6	0	1	7	0	1	34
France	1	395	84	0	14	45	3	21	563
Germany	0	219	61	0	6	16	2	59	363
Greece	1	43	2	1	0	0	0	4	51
Hungary	1	28	33	0	0	0	0	5	67
Ireland	0	84	2	0	1	1	0	1	89
Italy	1	75	19	0	4	16	3	34	152
Latvia	0	1	0	0	0	0	0	1	2
Lithuania	0	28	4	0	0	0	0	10	42
Luxembourg	0	0	0	0	0	0	0	2	2
Malta	0	2	1	0	0	3	0	0	6
Netherlands	0	66	3	0	1	13	2	0	85
Poland	2	152	96	0	2	2	0	28	282
Portugal	0	52	2	2	0	10	0	12	78
Romania	1	29	5	0	1	0	0	32	68
Slovakia	0	11	3	0	0	1	0	6	21
Slovenia	0	9	1	0	0	2	1	0	13
Spain	1	308	67	22	8	4	1	20	431
Sweden	0	15	14	0	1	32	0	6	68
United Kingdom	1	837	29	0	34	96	1	38	1 036
EU Total	**9**	**2 539**	**497**	**27**	**78**	**266**	**13**	**327**	**3 756**
Iceland	0	2	0	0	0	0	0	0	2
Norway	0	10	4	1	2	20	0	0	37
EU/EEA total	**9**	**2 551**	**501**	**28**	**80**	**286**	**13**	**327**	**3 795**

NGA = non groupable, O = other, Unk = unknown. The specific codes are kept for the most common serogroups. Others are the remaining/other groupable serogroups that should be reported.

Table C14. Number of cases and notification rates of IMD cases, by serogroup, EU/EEA countries, 2008–11 (n=16 651)

Serogroup	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
A	17	0.00	25	0.00	13	0.00	9	0.00
B	3 392	0.67	3 168	0.62	2 554	0.50	2 551	0.50
C	676	0.13	584	0.12	495	0.10	501	0.10
NGA	50	0.01	57	0.01	41	0.01	28	0.01
W135	82	0.02	87	0.02	82	0.02	80	0.02
Y	143	0.03	195	0.04	207	0.04	286	0.06
O	11	0.00	16	0.00	16	0.00	13	0.00
Unk	339	0.07	328	0.06	278	0.05	327	0.06
Total	4 710	0.93	4 460	0.88	3 686	0.73	3 795	0.75

NGA = non groupable, O = other, Unk = unknown. The specific codes are kept for the most common serogroups. Others are the remaining/other groupable serogroups that should be reported.

Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Table C15. Distribution of IMD serogroups by gender, EU/EEA countries, 2011 (3 455*)

Serotype	Male		Female		UNK
	N	%	N	%	N
A	3	0.2	6	0.4	0
B	1 318	73.8	1 223	73.3	10
C	273	15.3	228	13.7	0
NGA	19	1.1	9	0.5	0
W135	36	2.0	44	2.6	0
Y	132	7.4	151	9.0	3
O	5	0.3	8	0.5	0
Total	1 786		1 669		

** Overall 13 missing cases for gender among all serogroups: serogroup B (N missing=10), and Y (n=3)*

NGA = non groupable, O = other. The specific codes are kept for the most common serogroups. Others are the remaining/other groupable serogroups that should be reported.

Table C16. Notification rate of serogroup B, C and Y IMD by age group, EU/EEA countries, 2011 (n=3 328)

Age Group	B		C		Y	
	N	NR	N	NR	N	NR
< 1 year	535	10.02	49	0.92	11	0.21
1-4 years	696	3.28	75	0.35	15	0.07
5-14 years	301	0.58	50	0.10	28	0.05
15-24 years	477	0.80	136	0.23	61	0.10
25-49 years	228	0.13	93	0.05	39	0.02
50-64 years	150	0.16	43	0.04	31	0.03
≥65 years	155	0.18	55	0.06	100	0.11

Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Table C17. Total number of reported serogroup B IMD cases by age group and country, 2011 (n=2 543)

Country	<1 year		1-4 years		5-14 years		15-24 years		25-49 years		50-64 years		≥65 years		Total	
	N	NR	N	NR	N	NR	N	NR	N	NR	N	NR	N	NR	N	NR
Austria	1	1.3	2	0.6	4	0.5	6	0.6	1	0.0	0	0.0	1	0.1	15	0.2
Belgium	14	10.8	22	4.3	8	0.7	18	1.4	10	0.3	7	0.3	4	0.2	83	0.8
Cyprus	0	-	0	-	0	-	1	-	0	-	0	-	0	-	1	-
Czech Republic	7	6.0	11	2.4	1	0.1	7	0.5	5	0.1	2	0.1	1	0.1	34	0.3
Denmark	4	6.3	5	1.9	2	0.3	7	1.0	4	0.2	2	0.2	3	0.3	27	0.5
Estonia	1	6.3	1	1.6	0	0.0	2	1.1	0	0.0	1	0.4	0	0.0	5	0.4
Finland	1	1.6	3	1.2	1	0.2	10	1.5	2	0.1	1	0.1	1	0.1	19	0.4
France	70	8.4	91	2.8	43	0.5	98	1.2	41	0.2	30	0.2	22	0.2	395	0.6
Germany	40	5.9	46	1.7	22	0.3	60	0.7	25	0.1	11	0.1	15	0.1	219	0.3
Greece	6	5.2	8	1.7	10	1.0	10	0.9	5	0.1	3	0.1	1	0.0	43	0.4
Hungary	5	5.6	9	2.3	2	0.2	5	0.4	4	0.1	1	0.0	2	0.1	28	0.3
Iceland	0	0.0	1	5.3	0	0.0	0	0.0	1	0.9	0	0.0	0	0.0	2	0.6
Ireland	29	38.6	26	9.0	11	1.8	9	1.7	6	0.3	0	0.0	3	0.6	84	1.9
Italy	10	1.8	15	0.7	15	0.3	16	0.3	9	0.0	5	0.0	5	0.0	75	0.1
Latvia	0	0.0	1	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0
Lithuania	2	5.6	1	0.8	3	0.9	14	2.9	5	0.4	1	0.2	2	0.4	28	0.9
Malta	0	0.0	0	0.0	0	0.0	1	1.7	1	0.7	0	0.0	0	0.0	2	0.5
Netherlands	13	7.1	21	2.8	4	0.2	14	0.7	5	0.1	6	0.2	3	0.1	66	0.4
Norway	3	4.9	4	1.6	0	0.0	0	0.0	1	0.1	1	0.1	1	0.1	10	0.2
Poland	35	8.5	40	2.5	21	0.6	29	0.6	11	0.1	12	0.1	4	0.1	152	0.4
Portugal	18	17.8	11	2.7	6	0.5	5	0.4	3	0.1	3	0.2	3	0.2	49	0.3
Romania	4	1.9	11	1.3	7	0.3	4	0.1	0	0.0	3	0.1	0	0.0	29	0.1
Slovakia	1	1.7	6	2.7	0	0.0	2	0.3	1	0.0	0	0.0	1	0.1	11	0.2
Slovenia	1	4.5	3	3.6	1	0.5	3	1.3	1	0.1	0	0.0	0	0.0	9	0.4
Spain	65	13.1	87	4.4	51	1.1	29	0.6	24	0.1	14	0.2	34	0.4	304	0.7
Sweden	2	1.7	4	0.9	2	0.2	6	0.5	1	0.0	0	0.0	0	0.0	15	0.2
United Kingdom	203	25.3	267	8.6	87	1.2	122	1.5	62	0.3	47	0.4	49	0.5	837	1.3

Table C18. Notification rate of serogroup B IMD by year and age group, EU/EEA countries, 2008-11 (n=11 584)

Age group	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
< 1 year	946	17.79	841	15.81	572	10.76	535	10.06
1-4 years	778	3.69	718	3.40	681	3.23	696	3.30
5-14 years	395	0.77	413	0.80	294	0.57	301	0.58
15-24 years	598	1.01	600	1.02	462	0.78	477	0.81
25-49 years	310	0.18	266	0.15	230	0.13	228	0.13
50-64 years	183	0.19	163	0.17	153	0.16	150	0.16
≥65 years	160	0.18	146	0.17	133	0.15	155	0.18

Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Table C19. Total number of reported serogroup C IMD cases by age group and country, 2011 (n=501)

Country	<1 year		1-4 years		5-14 years		15-24 years		25-49 years		50-64 years		≥65 years		Total	
	N	NR	N	NR	N	NR	N	NR	N	NR	N	NR	N	NR	N	NR
Austria	2	2.6	0	0.0	1	0.1	3	0.3	1	0.0	1	0.1	0	0.0	8	0.1
Belgium	2	1.5	0	0.0	0	0.0	5	0.4	0	0.0	0	0.0	8	0.4	15	0.1
Czech Republic	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0	1	0.1	2	0.0
Denmark	4	6.3	9	3.4	4	0.6	7	1.0	4	0.2	5	0.5	6	0.6	39	0.7
Estonia	0	0.0	0	0.0	0	0.0	1	0.6	0	0.0	0	0.0	0	0.0	1	0.1
Finland	0	0.0	0	0.0	1	0.2	2	0.3	0	0.0	1	0.1	2	0.2	6	0.1
France	9	1.1	9	0.3	8	0.1	31	0.4	12	0.1	4	0.0	11	0.1	84	0.1
Germany	6	0.9	8	0.3	1	0.0	23	0.3	14	0.0	2	0.0	7	0.0	61	0.1
Greece	0	0.0	0	0.0	1	0.1	1	0.1	0	0.0	0	0.0	0	0.0	2	0.0
Hungary	4	4.5	2	0.5	4	0.4	12	1.0	7	0.2	3	0.1	1	0.1	33	0.3
Ireland	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.3	0	0.0	2	0.0
Italy	2	0.4	4	0.2	2	0.0	5	0.1	2	0.0	2	0.0	2	0.0	19	0.0
Lithuania	0	0.0	3	2.3	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	4	0.1
Malta	0	0.0	0	0.0	0	0.0	1	1.7	0	0.0	0	0.0	0	0.0	1	0.2
Netherlands	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	1	0.0	1	0.0	3	0.0
Norway	0	0.0	2	0.8	0	0.0	0	0.0	1	0.1	0	0.0	1	0.1	4	0.1
Poland	10	2.4	26	1.6	12	0.3	22	0.4	16	0.1	6	0.1	4	0.1	96	0.3
Portugal	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0	1	0.1	2	0.0
Romania	0	0.0	2	0.2	1	0.0	1	0.0	1	0.0	0	0.0	0	0.0	5	0.0
Slovakia	2	3.3	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0	3	0.1
Slovenia	0	0.0	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0	0	0.0	1	0.0
Spain	2	0.4	4	0.2	9	0.2	12	0.3	24	0.1	9	0.1	7	0.1	67	0.1
Sweden	2	1.7	2	0.4	0	0.0	5	0.4	2	0.1	0	0.0	3	0.2	14	0.1
United Kingdom	4	0.5	4	0.1	5	0.1	1	0.0	9	0.0	6	0.1	0	0.0	29	0.0

Table C20. Total number of reported serogroup C IMD cases by age group and country, notification rates of serogroup C IMD cases in countries with and without Meningococcal C conjugate (MCC) vaccination in their routine immunisation schedule, by age group, EU/EEA countries, 2011 (n=501)

Age group	Countries with MCC	Countries without MCC
< 1 year	0.7	1.7
1-4 years	0.2	0.9
5-14 years	0.1	0.2
15-24 years	0.2	0.3
25-49 years	0.0	0.1
50-64 years	0.0	0.1
≥65 years	0.1	0.1

Contributing countries with MCC: Austria, Belgium, France, Germany, Greece, Iceland, Ireland, Italy, Netherlands, Portugal, Spain, United Kingdom.

Contributing countries without MCC: Czech Republic, Denmark, Estonia, Finland, Hungary, Lithuania, Malta, Norway, Poland, Romania, Slovakia, Slovenia, Sweden.

Table C21. Notification rate of serogroup C IMD by year and age group, EU/EEA countries, 2008–2011 (n=2 233)

Age group	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
< 1 year	59	1.11	57	1.07	44	0.83	49	0.92
1-4 years	96	0.46	94	0.45	100	0.47	75	0.36
5-14 years	95	0.18	102	0.20	57	0.11	50	0.10
15-24 years	197	0.33	142	0.24	109	0.18	136	0.23
25-49 years	116	0.07	96	0.05	91	0.05	93	0.05
50-64 years	57	0.06	44	0.05	36	0.04	43	0.04
≥65 years	55	0.06	48	0.06	37	0.04	55	0.06
Total	675	0.14	583	0.12	474	0.10	501	0.10

Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Table C22. Notification rates of serogroup C IMD in cases aged <5 years in countries with and without Meningococcal C conjugate (MCC) vaccination in their routine immunisation schedule, EU/EEA countries, 2008-11 (n=563)

	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
Countries with MCC	99	0.49	74	0.37	70	0.35	56	0.28
Countries without MCC	54	0.86	71	1.13	74	1.18	65	1.03

Contributing countries with MCC: Austria, Belgium, France, Germany, Greece, Iceland, Ireland, Italy, Netherlands, Portugal, Spain, United Kingdom.

Contributing countries without MCC: Czech Republic, Denmark, Estonia, Finland, Hungary, Lithuania, Norway, Poland, Romania, Slovakia, Slovenia, Sweden.

Table C23. Total of reported serogroup Y IMD cases by age group and country, 2011 (n=285)

Country	<1 year		1-4 years		5-14 years		15-24 years		25-49 years		50-64 years		≥65 years		Total	
	N	NR	N	NR	N	NR	N	NR	N	NR	N	NR	N	NR	N	NR
Austria	1	1.28	0	0.00	1	0.12	0	0.00	0	0.00	0	0.00	0	0.00	2	0.02
Belgium	0	0.00	0	0.00	1	0.08	0	0.00	1	0.03	1	0.05	6	0.32	9	0.08
Czech Republic	0	0.00	0	0.00	0	0.00	0	0.00	1	0.03	1	0.05	0	0.00	2	0.02
Denmark	0	0.00	0	0.00	0	0.00	3	0.43	1	0.05	1	0.09	0	0.00	5	0.09
Finland	0	0.00	0	0.00	0	0.00	1	0.15	2	0.12	1	0.09	3	0.32	7	0.13
France	3	0.36	6	0.19	4	0.05	12	0.15	3	0.01	2	0.02	15	0.14	45	0.07
Germany	0	0.00	0	0.00	0	0.00	3	0.03	1	0.00	0	0.00	12	0.07	16	0.02
Ireland	0	0.00	0	0.00	1	0.16	0	0.00	0	0.00	0	0.00	0	0.00	1	0.02
Italy	1	0.18	1	0.04	5	0.09	2	0.03	5	0.02	1	0.01	1	0.01	16	0.03
Malta	0	0.00	0	0.00	0	0.00	1	1.74	0	0.00	0	0.00	2	3.09	3	0.72
Netherlands	0	0.00	0	0.00	1	0.05	4	0.20	3	0.05	1	0.03	4	0.15	13	0.08
Poland	1	0.99	0	0.00	1	0.09	0	0.00	0	0.00	0	0.00	0	0.00	2	0.02
Portugal	0	0.00	3	0.35	1	0.05	3	0.10	1	0.01	1	0.02	0	0.00	9	0.03
Slovakia	0	0.00	1	0.44	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.02
Slovenia	0	0.00	0	0.00	0	0.00	1	0.44	0	0.00	0	0.00	1	0.30	2	0.10
Spain	0	0.00	1	0.05	1	0.02	1	0.02	0	0.00	0	0.00	1	0.01	4	0.01
Sweden	0	0.00	1	0.22	2	0.20	8	0.64	3	0.10	6	0.34	12	0.69	32	0.34
United Kingdom	5	0.62	2	0.06	8	0.11	15	0.18	12	0.06	14	0.12	40	0.38	96	0.15
Norway	0	0.00	0	0.00	2	0.33	7	1.09	6	0.35	2	0.22	3	0.40	20	0.41

Table C24. Notification rate of serogroup Y IMD by year and age group, EU/EEA countries, 2008-11 (n=830)

Age group	2008		2009		2010		2011	
	N	NR	N	NR	N	NR	N	NR
< 1 year	9	0.17	9	0.17	11	0.21	11	0.21
1-4 years	4	0.02	6	0.03	10	0.05	15	0.07
5-14 years	16	0.03	15	0.03	13	0.03	28	0.05
15-24 years	29	0.05	52	0.09	63	0.11	61	0.10
25-49 years	15	0.01	18	0.01	26	0.01	39	0.02
50-64 years	21	0.02	26	0.03	25	0.03	31	0.03
≥65 years	49	0.06	69	0.08	59	0.07	100	0.12

Contributing countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Table C25. Number and percentage distribution of FetVR variants in reported cases of invasive meningococcal disease, EU/EEA, 2011 (n=1 287)

Result FetVR	N	%
F3-3	252	19.6
F1-5	215	16.7
F4-1	123	9.6
F3-9	95	7.4
F3-6	91	7.1
F5-5	75	5.8
F5-1	57	4.4
F1-7	50	3.9
F5-8	47	3.7
F5-9	32	2.5
Others	250	19.4

N = Number of cases, % = proportion of cases for which ResultFetVR was known.

Table C26. Number and percentage distribution of MLST clonal complexes in reported cases of IMD, EU/EEA, 2011 (N=900)

Result MLST	N	%
ST-41/44	189	21.0
ST-32	167	18.6
ST-11	138	15.3
ST-23	101	11.2
ST-269	52	5.8
ST-213	44	4.9
ST-103	39	4.3
ST-18	25	2.8
ST-162	26	2.9
ST-461	24	2.7
Others	95	10.6

N = Number of cases, % = proportion of cases for which ResultMLST was known.

Table C27. Percentage of virulent meningococcal clonal complexes, by serogroup, EU/EEA, 2011 (N=900)

Result MLST	B		C		Y		W135		Other		NGA		Unknown	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
ST-103	2	0.4	35	16.9	2	1.7	0	0.0	0	0.0	0	0.0	0	0.0
ST-11	10	1.8	123	59.4	0	0.0	5	23.8	0	0.0	0	0.0	0	0.0
ST-1157	1	0.2	1	0.5	0	0.0	0	0.0	1	33.3	0	0.0	0	0.0
ST-116	2	0.4	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-162	25	4.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	16.7
ST-167	2	0.4	0	0.0	11	9.2	0	0.0	0	0.0	0	0.0	0	0.0
ST-174	3	0.6	1	0.5	2	1.7	0	0.0	0	0.0	0	0.0	0	0.0
ST-175	0	0.0	0	0.0	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0
ST-18	22	4.1	2	1.0	0	0.0	1	4.8	0	0.0	0	0.0	0	0.0
ST-198	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-213	44	8.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-22	1	0.2	0	0.0	0	0.0	13	61.9	0	0.0	0	0.0	1	16.7
ST-23	0	0.0	0	0.0	99	83.2	1	4.8	0	0.0	0	0.0	1	16.7
ST-254	2	0.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-269	48	8.8	4	1.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-32	151	27.8	13	6.3	1	0.8	0	0.0	0	0.0	0	0.0	2	33.3
ST-334	0	0.0	8	3.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-35	10	1.8	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-37	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-41/44	172	31.7	16	7.7	0	0.0	0	0.0	0	0.0	0	0.0	1	16.7
ST-461	24	4.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-53	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-549	2	0.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-60	4	0.7	0	0.0	0	0.0	0	0.0	2	66.7	1	100.0	0	0.0
ST-8	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ST-865	15	2.8	1	0.5	2	1.7	1	4.8	0	0.0	0	0.0	0	0.0
ST-92	0	0.0	0	0.0	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0
Total	543		207		119		21		3		1		6	

NGA = Non groupable

Table C28. Number and percentage distribution of PorA1 variants in reported cases of IMD, EU/EEA, 2011 (N=1,473)

PorA1 variant	N	%
7, 2	236	16.0
22	186	12.6
5, 1	171	11.6
5	155	10.5
7	122	8.3
5, 2	113	7.7
18, 1	106	7.2
19	70	4.8
21	62	4.2
7, 1	42	2.9
Others	210	14.3

N = Number of cases, % = proportion of cases for which ResultPorA1 was known.

Table C29. Number and percentage distribution of PorA2 variants in reported cases of IMD, EU/EEA, 2011 (N=1,473)

PorA2 variant	N	%
4	160	10.9
16	157	10.7
2	147	10.0
14	139	9.4
10, 1	98	6.7
3	82	5.6
10, 8	71	4.8
15	63	4.3
9	58	3.9
1	45	3.1
Others	453	30.8

N = Number of cases, % = proportion of cases for which ResultPorA2 was known.