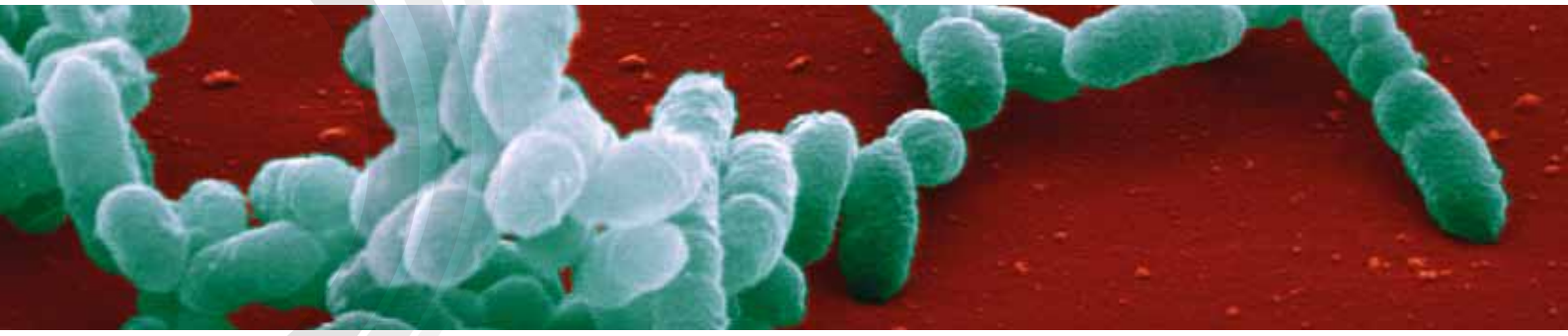
ecdc
EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

SURVEILLANCE REPORT



Surveillance of invasive bacterial diseases in Europe

Invasive *Haemophilus influenzae* disease and invasive meningococcal disease

2010

www.ecdc.europa.eu

ECDC SURVEILLANCE REPORT

Surveillance of invasive bacterial diseases in Europe, 2010

Invasive *Haemophilus influenzae* disease, invasive meningococcal disease

This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Ida Czumbel
Contributing authors
Denis Coulombier, Andrew J. Amato-Gauci, Phillip Zucs, Pierluigi Lopalco, Lucia Pastore-Celentano and Františka Hruba.

Acknowledgements
The authors gratefully acknowledge all national *Haemophilus influenzae* and meningococcal disease experts for their hard work and dedication in reporting 2010 IBD national data and reviewing this report:

Gabriela Elbelazi, Sigrid Heuberger (Austria); Sophie Quoilin, Sophie Bertrand, Françoise Crokaert (Belgium); Teodora Georgieva, Dimitar Nashev (Bulgaria); Despo Pieridou Bagatzouni, Chrystalla Hadjianastassiou (Cyprus).

Vera Lebedova, Pavla Krizova, Cestmir Benes, (Czech Republic); Kåre Mølbak, Lotte Munch Lambertsen (Denmark); Irina Dontsenko, Natalia Kerbo, Tiiu Aro, Rita Peetso (Estonia); Natalja Kuznetsova, Kuusi Markku, Anni-Riitta Virolainen-Julkunen, Käyhty Helena, Maija Toropainen (Finland); Agnes Lepoutre, Muhamed Khier Taha, Olivier Gaillot, Isabelle Parent Du Chatelet, Scarlett George (France); Matthias Frosch, Anette Siedler, Hellenbrand Wiebke, Ulrich Vogel (Germany); Georgina Tzanakaki, Theofano Georgakopoulou (Greece); Toth Akos, Horvath Judith Krisztina (Hungary), Katalin Krisztalovics; Haraldur Briem, Gudnason Thorolfur, Hardardottoir Jordish (Iceland); Margareta Fitzgerald, Suzanne Cotter (Ireland); Stefania Iannazzo, Marina Cerquetti, Paola Mastrantonio, Maria Grazia Caporali, Paola Stefanelli, Paolo D'Ancona (Italy); Irina Lucenko, Jelena Galajeva, Ramona Butirina, Leva Kantsone (Latvia), Sabine Erne (Liechtenstein), Egle Pauzaite, Migle Janulaitiene (Lithuania).

Pierrette Huberty-Krau (Luxembourg); Paul Caruana, Jackie Maistre Melillom, Tanya Melillo Fenech (Malta); Hester de Melker, Lodewijk Spanjaard, Arie Van der Ende, Mirjam Knol (Netherlands); Dominique Caugant, Kirsten Konsmo, Martin Steinbakk (Norway); Andrzej Zielinski, Alicja Kuch, Anna Skoczynska, Iwona Paradowska Stankiewicz (Poland); Paula Lavado, Laurinda Queiros, Maria Joao Simoes Carlos Orta Gomes, Erik De Jonge (Portugal); Aurora Stanescu, Marina Pana, Lavinia Zota, Giuca Mihaela Cristina (Romania); Sarka Kovacsova, Elena Novakova, Henrieta Hudeckova, Maria Slacikova, Alena Vaculikova (Slovakia); Metka Paragi, Tamara Kastrin, Verica Mioc (Slovenia); Jose Campos, Maria Perez Vazquez, Julio Moreno Vazquez, Rosa Portero Cano (Spain); Birgitta Henriques, Tiia Lepp, Per Olcen (Sweden); Edward Kaczmarski, Narendra Nirmal, Mary Ramsay, Mary Slack (United Kingdom).

Suggested citation: European Centre for Disease Prevention and Control. Surveillance of invasive *H. influenzae* and invasive meningococcal disease in Europe 2010. Stockholm: ECDC; 2013.

Stockholm, December 2013

ISBN 978-92-9193-540-6

ISSN 1977-2378

doi 10.2900/10072

Catalogue number TQ-AK-13-001-EN-C

Contents

Figures

Tables

Abbreviations

CFR	Case–fatality ratio
EEA	European Economic Area
EU	European Union
EUCAST	European Committee on Antimicrobial Susceptibility Testing
EU-IBIS	European Union Invasive Bacterial Infections Surveillance Network
Eurostat	Statistical office of the European Union
Hib	*H. influenzae* type b
IBD	Invasive bacterial disease
IMD	Invasive meningococcal disease
MCC	Meningococcal C conjugate vaccination
MIC	Minimal inhibitory concentration
MLST	Multilocus sequence typing
MS	Member State
PCR	Polymerase chain reaction
WHO	World Health Organization

Executive summary

This report describes the epidemiology of invasive bacterial disease due to *Haemophilus influenzae* and *Neisseria meningitidis* in EU and EEA Member States in 2010. The main public health issues are the following:

- *H. influenzae* disease was predominantly found in infants and in the age group of 65 years and older.
- *H. influenzae* b notifications are steadily decreasing.
- The age groups most affected by *H. influenzae* serotype b were still children below five years of age.
- Non-capsulated and non-b *H. influenzae* were the most frequently reported serotypes.
- Despite the yearly variations of non-capsulated and non-b notification rates, their trend line is slightly increasing.
- Although the surveillance systems for invasive bacterial diseases continue to be very diverse across Europe and case definitions differ for some countries, certain trends in incidence and serogroup distribution can be deduced from the data provided. Data completeness is improving, but still fairly low for the enhanced set of variables.
- Invasive meningococcal disease (IMD) remains rare in Europe, with a decrease in notification rate by over 60% compared to 1999.
- Infants and children suffer the highest rates of IMD.
- Serogroup B causes the majority of IMD.
- In countries with meningococcal C conjugate vaccination (MCC), the proportion of IMD cases due to serogroup C is lower than in countries without MCC vaccination.

Invasive *Haemophilus influenzae* disease

In 2010, 1 828 confirmed cases of invasive *H. influenzae* disease were reported by 24 countries through comprehensive surveillance, representing an overall European notification rate of 0.43 per 100 000 population. The notification rates varied across Member States. The rates in the Nordic countries, in particular in Sweden (1.92/100 000) and Norway (1.83) were higher than in the rest of Europe. However, rates in 21 of 25 countries remained below one case per 100 000 population.

As in previous years, notification rates were highest among infants younger than one year of age (2.65/100 000) and persons over 65 years old (1.1/100 000). Of all cases reported in 2010, more than 50% were among adults 65 years of age and older.

Non-capsulated strains were the most frequently reported serotype in Europe (68%), followed by non-b serotype (16%) and serotype b (16%). The high proportion of non-capsulated strains may be partly attributable to an improved sensitivity of surveillance systems and physicians' awareness of the disease and their reporting duties; however, it could also be explained by actual changes in the epidemiology of the disease.

Following introduction of the *H. influenzae* type b (Hib) conjugate vaccine, a gradual decrease in the notification rate of Hib disease has been observed in Europe in almost all age groups. At the same time, the notification of non-type b disease is becoming relatively more frequent. The overall notification rate of Hib at the European level is decreasing despite an increasing trend of non-capsulated strains in young adults. However, unlike with pneumococcal conjugate vaccination, there is no robust evidence to suggest that mass Hib vaccination in infancy has led to serotype replacement.

With the data available, it was not possible to assess primary or secondary vaccine failures. Vaccination status was only reported for 19% of cases and by few countries. No data were collected on type of vaccine, number of doses received, time interval between doses, date of the last dose and risk factors for vaccine failure.

Invasive meningococcal disease

In 2010, 3 819 cases of IMD were notified in the EU/EEA with an overall notification rate of 0.8 per 100 000 population. Almost all cases were laboratory-confirmed (97%). IMD appears to be rare in the majority of Member States. The three most affected countries were Ireland (2.55 per 100 000), UK (1.69) and Lithuania (1.44). Overall, there is a sustained declining trend in Europe.

The most affected age group were infants under the age of one, followed by 1–4 year old children and teenagers 15–19 years of age. Among the older age groups, IMD was only rarely reported.

As in previous years, B formed the largest proportion (75%) of known serogroups, taking into account known cases, followed by serogroup C (15%). The proportion of serogroup Y cases increased from 4% in 2009 to 6% in 2010. As previously observed, the highest proportion of serogroup Y were notified in those aged 65 years and older (28%) and in 15–19 year olds (24%). While in most of Europe, the proportion of serogroup Y disease ranged between 0% and 11%, it accounted for 33% to 38% in Finland, Norway and Sweden.

Serogroup A remains rare in Europe with 21 countries not reporting any cases. The highest proportion was notified by Estonia with 50% of reported cases. In countries reporting cases of serogroup A disease, proportions ranged between 0.2% and 2.5%.

In countries with MCC, the serogroup C notification rate continued to decline and, as previously, was lower in age groups targeted by vaccination (<1 year: 0.58/100 000; 1–4 years: 0.19/100 000), compared with countries without MCC vaccination (<1 year: 1.21/100 000; 1–4 years: 0.95/100 000).

Multilocus sequence typing (MLST) data was available for only 771 (19%) cases from 12 countries. MLST showed that the bacterial population was highly diverse, comprising 24 different clonal complexes (cc), with ST-41/44 complex accounting for 24% of isolates (n=256) while ST-32 complex (17 % n=129) was the second most commonly reported complex. ST-32 strains (25% of cases with known MLST and outcome) proved to be the most severe.

Outcome was available in 88% of cases. With 299 deaths attributed to IMD, the overall case–fatality ratio was 8%. Although serogroup B strains were the most frequently reported, they had a lower CFR (6%) than non-groupable (NGA) (17%), A (15%) and C strains (13.0%) that were responsible for the majority of deaths.

Until vaccines against serogroup B meningococci become available for universal use, the main methods of control remain the early diagnosis and adequate management of primary cases and the prevention of secondary cases.

1 Introduction

Invasive bacterial infections caused by *H. influenzae* and *N. meningitidis* represent a significant public health problem across Europe due to the rapid onset of disease, high case fatality and the high proportion of surviving patients with severe complications, such as permanent disabilities including neurological sequelae. Infants and children below five years are the most affected age group. Early diagnosis and treatment are essential to the control of invasive bacterial disease.

The incidence of Hib disease has decreased substantially after introducing the vaccine [1]. Likewise, introducing vaccination against meningococcal serogroup C in several European countries has resulted in a decreasing notification rate of serogroup C IMD in the last decade [2]

The surveillance of these diseases is important to estimate their incidence, to monitor disease trends and changes in serogroup/serotype and genotype distribution. Since the number of reported cases is steadily decreasing, pooling European data increases the precision of estimates.

This report aims to describe the main surveillance elements and basic epidemiological features of invasive *H. influenzae* and meningococcal disease in Europe in 2010.

2 Methods

2.1 Case definition

2.1.1 Invasive *H. influenzae* disease

Confirming an invasive *H. influenzae* infection requires isolating and culturing the bacterium from a sterile body site such as: cerebrospinal fluid (CSF), blood, joint fluid, pleural effusion, pericardial effusion, peritoneal fluid, subcutaneous tissue fluid, placenta, or amniotic fluid. Laboratory methods used to detect the pathogen are: culture, serology, immunologic tests, antigen detection, detection of nucleic acid, genotyping and sequencing.

For the 2010 data collection, participants were requested to report cases of invasive *H. influenzae* applying the 2008 EU case definition (Table A, Annex 1). However, several case definitions were used:

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

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 (Annex 1). 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.

2.1.2 Invasive meningococcal disease

Laboratory diagnosis of invasive *N. meningitidis* infection requires isolating and culturing the bacterium from a sterile body fluid such as: cerebrospinal fluid (CSF), blood, synovial, pleural or pericardial fluid, petechial skin and mucosal lesions. Laboratory methods used to detect the pathogen are: culture, serology, immunologic tests, antigen detection, detection of nucleic acid, genotyping and sequencing.

The case definitions for meningococcal disease also differed between Member States:

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

A major difference between the 2002 and 2008 versions of the EU case definition is that the latter defines cases as probable based on epidemiological criteria only and no longer based on unspecific laboratory methods. In addition, a confirmed case no longer needs to meet any clinical criteria (Table B1, Annex 2).

2.2 Data sources

This report includes cases of invasive *H. influenzae* and meningococcal disease reported by the national public health institutes in EU/EEA countries for 2010. The analysis was based on data uploaded in TESSy up to 31 August 2011. Historical data (1999–2006) were retrieved from the European Invasive Bacterial Infections Surveillance Network (EU-IBIS) database, now hosted by ECDC.

For invasive *H. influenzae* disease, Belgium, France and Spain reported sentinel surveillance data. For IMD, all reporting countries have a comprehensive, passive and compulsory surveillance system in place.

Tables Table A2 (Annex 1) and Table B2 (Annex 2) present an overview of surveillance systems by disease and country, listing the main characteristics of each data source.

The population based analyses used the population on 1 January of 2010 as the denominator. These data have been obtained from the Eurostat database[1] .

2.3 Data submission and validation

Designated national contact points were requested to submit data to TESSy using the latest metadata set agreed by the Member States. Data included epidemiological and laboratory variables. Of the 30 EU/EEA countries, all but Liechtenstein submitted data.

All participating countries have a surveillance system in place for both diseases. Twenty-eight countries reported case-based data for both diseases, and one country (Bulgaria) reported aggregated data. Clinically and laboratory-notified cases are linked at the national level and submitted to TESSy with a single record identifier.

The cleaning and validation process included automatic and manual checks aimed at identifying any inconsistency in the data. Validation rules were based on the EU 2008 case definition. Where inconsistencies were identified, experts from the countries affected were requested to re-upload their data. The draft report was shared with all Member States for comments and confirmation of national figures.

2.4 Data analysis

Notification rates were calculated by using numbers of cases as the numerator and total population as the denominator (see 2.2.1). Countries with sentinel surveillance and no population coverage were not included in the analysis of notification rates.

Only known laboratory methods were taken into account, as well as laboratory methods reported as 'unknown' for which the specimen was known. If neither the methods nor the specimens were reported, the case was excluded.

Vaccination failures were not analysed due to insufficient information provided by the current variables. The vaccination status 'fully vaccinated' and 'partly vaccinated' were defined by the reporting country according to its immunisation schedule.

Unless stated otherwise, all 'unknown' and 'missing' responses were excluded from analysis.

Case fatality was analysed including all countries that reported at least one case with a known outcome. Case-based data were missing from Bulgaria, which was therefore excluded from this analysis. Spain does not collect outcome data.

It should be noted that the annual number of cases by country is calculated over a reporting period of one year as per 'date used for statistics'; 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.

[1]Eurostat database available here: http://epp.eurostat.ec.europa.eu

2.4.1 Invasive *H. influenzae* disease

Only confirmed cases were taken into account. Cases were described by age, gender, seasonality, clinical presentation, outcome, serotype, laboratory method and specimen used for confirming a case, and vaccination status.

The notification data and the age-specific population data were aggregated into the following age groups: <1, 1–4, 5–14, 15–64 and ≥65 years.

The serotypes were classified in three major groups: serotype b; non-b (a, c, d, e, f, unspecified non-b); and non-capsulated (non-typeable).

The time trends in notification rates by serotype expressed as numbers of confirmed cases of either serotype b, non-b or non-capsulated (non-typeable) per population of 100 000 were analysed.

Compared to previous years, the selection criteria have been changed by reducing the study period to 2007–2010 and increasing the number of countries included in the analysis in order to have a broader overview of the European situation.

Only countries with consistent reporting were included in the analysis.

2.4.2 Invasive meningococcal disease

Cases were described by case classification, age, gender, seasonality, clinical presentation, outcome, importation and probable country of infection, vaccination status, specimen and test method used for confirming a case, serogroup, sequence type and susceptibility to ciprofloxacin, penicillin, rifampicin and ceftriaxone/cefotaxime.

For the analysis of the data containing laboratory variables, only 'confirmed' cases were filtered. For the general epidemiological variables, such as classification, seasonality, age and gender distribution, clinical presentation and case–fatality ratio, the total number of reported cases was taken into account.

The notification data and the age-specific population data were aggregated into the following age groups: <1, 1–4, 5–9, 10–14, 15–19, 20–24, 25–44, 45–64, ≥65 years.

The distributions of minimal inhibitory concentrations (MIC) were displayed rounding the values to the next two-fold dilution, and the proportion of resistance was calculated. Cut-off values for resistance were the values published by the European Committee on Antimicrobial Susceptibility Testing, if available. The cut-off values for penicillin and rifampicin were not available and resistance therefore not reported.

Trend analyses included countries consistently reporting at least one case per year between 1999–2009.

3 Results: invasive *Haemophilus influenzae* disease

3.1 Data quality

The completeness of reporting for case classification, age, gender and laboratory variables such as specimen and test method were high, ranging between 85% and 100% (Table A3, Annex 1). Clinical information ('Clinical Presentation' and 'Outcome') was available in 51% to 55% of cases, serotype information in 43%, and information on vaccination status in 11% of cases.

3.2 Laboratory methods used for strain identification

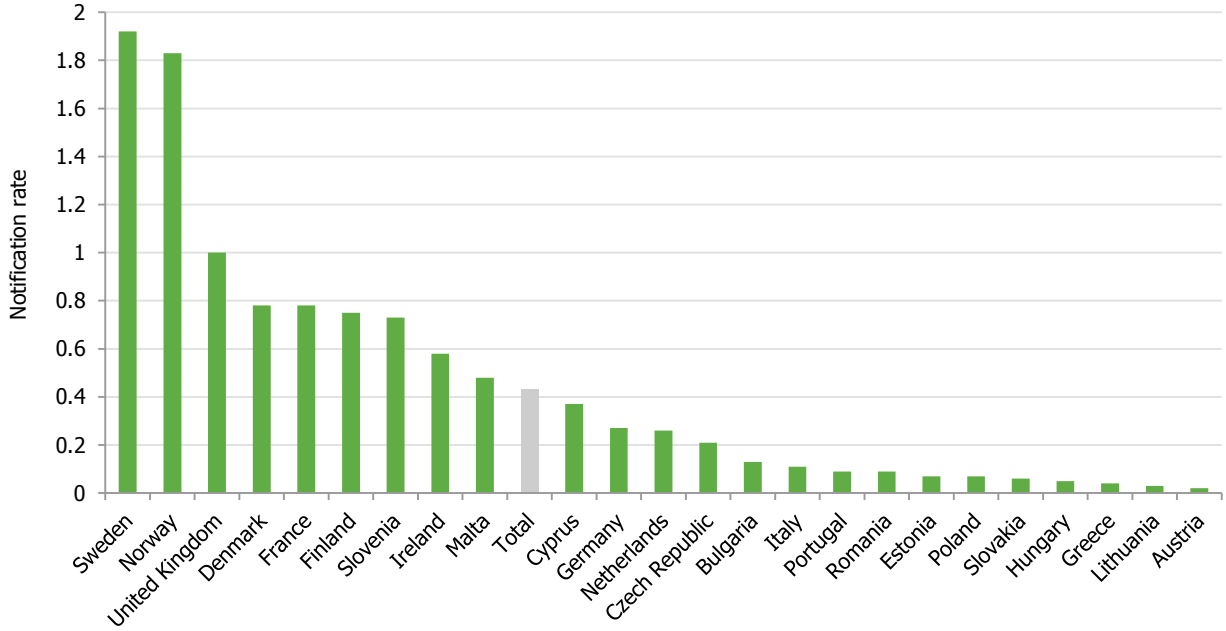
Information on specimen and test method was available for 92.5% and 85.6% of cases, respectively. Culture was the most frequently reported method, accounting for 84% of tests, and PCR-based techniques were reported in 3% of tests. No cases were identified by geno-sequencing or microscopy (Table A4, Annex 1).

3.3 Epidemiological analysis

In 2010, a total of 1 974 cases of invasive *H. influenzae* disease were reported from 29 countries. Belgium (n=68), France and Spain (n=78) reported data from sentinel surveillance. Iceland, Latvia and Luxembourg reported zero cases. (see Table A2 Annex 1). Cases with probable or unknown classification (n=3) were not included in the analysis.

The overall European notification rate was 0.43 per 100 000 population (Table 1). The highest rates were reported by Sweden (1.9/100 000) and Norway (1.8). The lowest rates above zero were reported from Austria (0.02/100 000), Greece (0.04) and Hungary (0.05) (Figure 1, Annex 1).

Figure 1. Notification rate* (per 100 000 population) of invasive H. *influenzae* disease by country, EU/EEA, 2010 (n=1 828)



**Belgium and Spain: no population coverage provided*

The incidence of the disease has decreased, or remained relatively low since 1999 in the majority of countries. Norway and Sweden reported notification rates of over 1.0 per 100 000 population in 2010.Only the Czech Republic appears to be experiencing an increased incidence in 2010 compared to 2009 data.

Table 1. Notification rates (per 100 000 population) and total number of cases of invasive *H. influenzae* disease by country, 1999–2010*

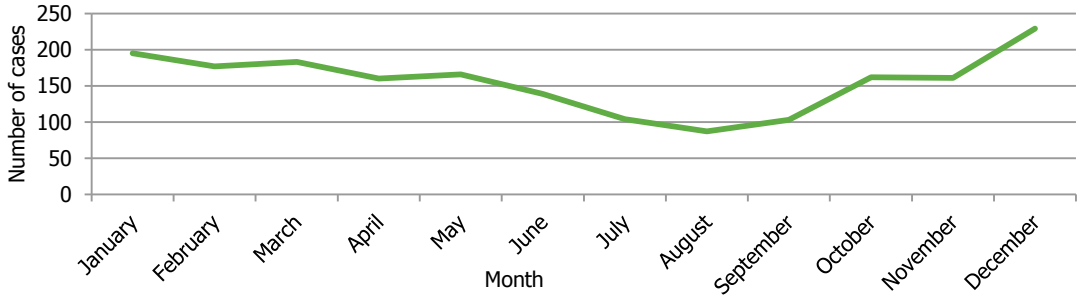
Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Austria	-	-	-	0.05 (4)	0.05 (4)	0.13 (11)	0.18 (15)	0.09 (7)	0.05 (4)	0.06 (5)	0.17 (14)	0.02 (2)
Belgium[1]	-	0.61 (63)	0.52 (54)	0.63 (65)	0.53 (55)	0.56 (58)	-	-	(55)	(49)	(76)	(68)
Bulgaria	-	-	-	-	-	-	-	-	0.26 (20)	0.18 (14)	0.20 (15)	0.13 (10)
Cyprus	-	-	-	-	-	-	-	-	0.00 (0)	0.00 (0)	0.25 (2)	0.37 (3)
Czech Republic[2]	1.00 (103)	1.02 (105)	0.90 (92)	0.55 (56)	0.49 (50)	0.16 (16)	0.18 (18)	0.11 (11)	0.13 (13)	0.07 (7)	0.10 (10)	0.21 (22)
Denmark[3]	0.09 (5)	0.04 (2)	0.02 (1)	0.02 (1)	0.07 (4)	0.07 (4)	0.07 (4)	0.07 (4)	0.28 (15)	0.58 (32)	0.56 (31)	0.78 (43)
Estonia[4]	0.22 (3)	0.07 (1)	0.22 (3)	0.22 (3)	0.07 (1)	1.33 (18)	1.49 (20)	0.60 (8)	0.22 (3)	0.08 (1)	0.08 (1)	0.07 (1)
Finland	0.56 (29)	0.72 (37)	0.95 (49)	0.44 (23)	0.69 (36)	0.50 (26)	0.84 (44)	0.61 (32)	1.02 (54)	0.85 (45)	0.88 (47)	0.75 (40)
France[5]	0.89 (521)	0.96 (565)	1.01 (598)	0.81 (479)	0.91 (546	1.01 (608)	1.06 (646)	0.98 (605)	1.06 (658)	1.10 (442)	-	0.78 (371)
Germany[6]	0.33 (42)	0.57 (73)	0.45 (57)	0.38 (47)	0.37 (46)	0.26 (32)	0.29 (34)	0.49 (57)	0.11 (93)	0.20 (160)	0.24 (196)	0.27 (224)
Greece[7]	0.35 (2)	0.52 (3)	0.34 (2)	1.39 (8)	0.50 (8)	0.56 (9)	0.13 (2)	0.19 (3)	0.06 (7)	0.04 (4)	0.12 (13)	0.04 (4)
Hungary[8]	-	-	-	-	0.07 (7)	0.12 (12)	0.01 (1)	0.00 (0)	0.02 (2)	0.06 (6)	0.03 (3)	0.05 (5)
Ireland	0.78 (27)	0.55 (21)	0.70 (27)	0.54 (21)	0.56 (22)	0.94 (38)	0.82 (34)	0.90 (38)	0.72 (31)	0.50 (22)	0.97 (43)	0.63 (28)
Italy	0.19 (109)	0.11 (64)	0.05 (31)	0.03 (19)	0.04 (24)	0.02 (9)	0.03 (15)	0.04 (23)	0.06 (33)	0.08 (50)	0.09 (56)	0.11 (69)
Latvia	-	-	-	-	0.13 (3)	0.04 (1)	0.00 (0)	0.00 (0)	0.00 (0)	0.04 (1)	0.04 (1)	0
Lithuania[8]	-	-	-	-	0.03 (1)	0.23 (8)	0.09 (3)	0.06 (2)	0.00 (0)	0.09 (3)	0.03 (1)	0.06 (2)
Luxembourg	-	-	-	-	-	-	-	-	0.21 (1)	0.00 (0)	0.00 (0)	0
Malta	0.00 (0)	0.26 (1)	0.00 (0)	0.00 (0)	0.00 (0)	0.77 (3)	0.00 (0)	0.00 (0)	0.25 (1)	0.00 (0)	0.73 (3)	0.48 (2)
Netherlands[13]	0.43 (68)	0.49 (77)	0.57 (91)	0.67 (108)	0.82 (132)	0.78 (127)	0.85 (139)	0.75 (122)	-	0.00 (0)	0.00 (0)	0.26 (43)
Poland[9]	0.06 (25)	0.08 (31)	0.09 (35)	0.09 (33)	0.09 (36)	0.08 (32)	0.05 (19)	0.05 (20)	0.11 (43)	0.07 (28)	0.05 (19)	0.07 (25)
Portugal	0.09 (9)	0.10 (10)	0.15 (16)	0.12 (12)	0.12 (13)	0.11 (12)	0.13 (14)	0.22 (23)	0.15 (16)	0.05 (5)	0.08 (8)	0.09 (10)
Romania	-	-	-	-	-	-	-	-	-	0.01 (2)	0.10 (22)	0.09 (19)
Slovakia	0.35 (19)	0.28 (15)	0.20 (11)	0.13 (7)	0.17 (9)	0.07 (4)	0.13 (7)	0.06 (3)	0.11 (6)	0.07 (4)	0.09 (5)	0.06(3)
Slovenia	-	0.65 (13)	0.85 (17)	0.40 (8)	0.65 (13)	0.70 (14)	0.40 (8)	0.65 (13)	0.65 (13)	0.60 (12)	0.89 (18)	0.73(15)
Spain[10]	-	-	-	-	-	-	-	-	(66)	(73)	(53)	(78)
Sweden[11]	0.18 (16)	0.34 (30)	0.21 (19)	0.25 (22)	0.27 (24)	0.41 (37)	1.29 (117)	1.32 (120)	1.58 (144)	1.78 (163)	1.58 (146)	1.92 (179)
United Kingdom	0.68 (400)	0.85 (498)	1.03 (605)	1.28 (757)	1.26 (750)	0.92 (550)	1.10 (661)	1.08 (650)	1.14 (696)	1.26 (773)	1.20 (742)	1.0 (622)
Iceland[12]	1.44 (4)	0.36 (1)	0.70 (2)	0.00 (0)	0.00 (0)	0.34 (1)	0.00 (0)	0.00 (0)	0.33 (1)	0.00 (0)	0.00 (0)	0.00 (0)
Norway	1.62 (72)	1.27 (57)	1.09 (49)	1.57 (71)	1.69 (77)	1.70 (78)	1.67 (77)	1.59 (74)	1.77 (83)	1.58 (75)	1.48 (71)	1.83 (89)
EU/EEA	0.52 (1 339)	0.55 (1 436)	0.62 (1 620)	0.61 (1 608)	0.66 (1 738)	0.60 (1 565)	0.66 (1 752)	0.63 (1 673)	0.41 (2 052)	0.41 (1 976)	0.36 (1 596)	0.43 (1 831)

**1999–2006: from EU-IBIS 2006 report. Population data derived from the Member States; 2007–2010: data source The European Surveillance System; Eurostat as population denominator source*
[1] Data collected by sentinel and voluntary surveillance system, not included in the analysis
[2] 1999–2004: Serotype b only.
[3] 1999–2006: Meningitis only/mostly meningitis; thereafter all clinical presentations.
[4] Serotype b only;
[5] Data collected by a sentinel surveillance system and corrected for the population coverage.
Country comment: The notification rate corrected for both the population coverage and under notification rate is 0.95.
[6] 1999–2006: Rates based on population<15 years old. From 2007 onwards, all age groups have been included.
[7] Mainly serotype b & non-b; meningitis and meningitis/septicaemia rates. 1999–2006: Rates were calculated based on population <15 years old; from 2007 onwards, all age groups have been included.
[8] Only meningitis and septicaemia.
[9] Serotype b; since 2004, non-capsulated serotypes have been added; 1999–2006: only meningitis.
[10] Data collected by sentinel surveillance, not included in the analysis
[11] 1999–2004: Only serotype b; 2000–2001: aggregated data.
[12] Serotype b
[13] Serotype b

3.3.1 Seasonality

The cases showed a typical seasonal distribution with the highest number of invasive *H. influenzae* infections reported during late autumn and winter, followed by a steady decrease until August (Figure 2). No differences were observed between Member States or serotypes.

Figure 2. Number of reported invasive *H. influenzae* cases by month*, EU/EEA, 2010 (n=1 866)



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

**Date used for statistics*

3.3.2 Gender distribution

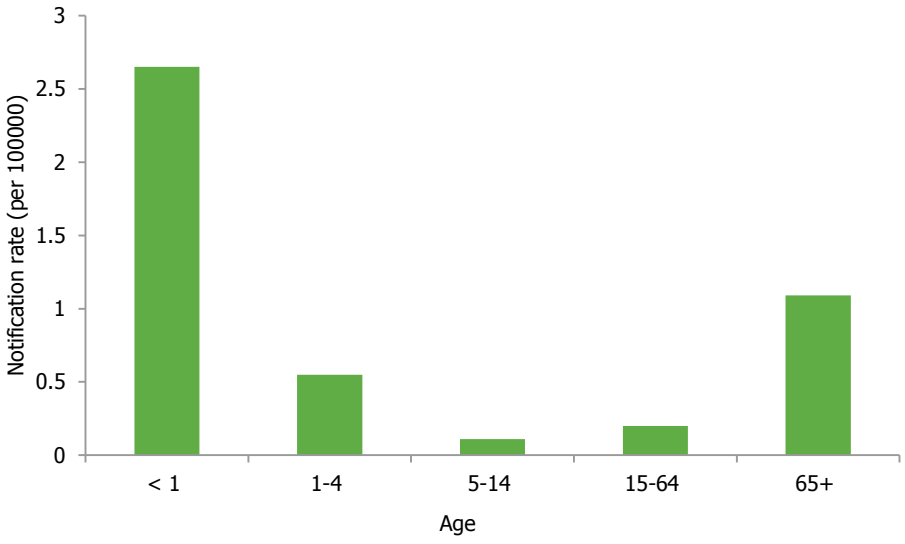
Information on gender was available for 1 450 cases. The disease was almost equally distributed among males and females in Europe, with a male-to-female ratio of 1.05.

Various countries, however, differed markedly from this gender balance. Males were more than twice as affected than females in Bulgaria, Poland, Portugal and Slovenia. Males were under-represented in Czech Republic, Finland, Greece, Hungary and Norway (Table A6, Annex 1).

3.3.3 Age distribution

Information on age was available in 79% of all cases. Of 1 443 cases with known age, 85% were 15 years and older, and 50% were 65 years and older. Notification rates were highest in infants younger than one year (2.7/100 000) and persons aged 65 years and older (1.1/100 000) (Figure 3).The highest country-specific rates in infants were reported from Slovenia and the United Kingdom (Table A7, Annex 1). The highest rates in the elderly were reported from Norway, Sweden and the United Kingdom.

Figure 3. Notification rate of confirmed *H. Influenzae* disease cases by age group, EU/EEA, 2010 (n=1 443)

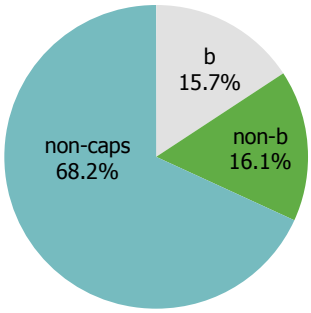


Contributing countries: Austria, Cyprus, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Malta, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden and the United Kingdom.

3.3.4 Serotypes

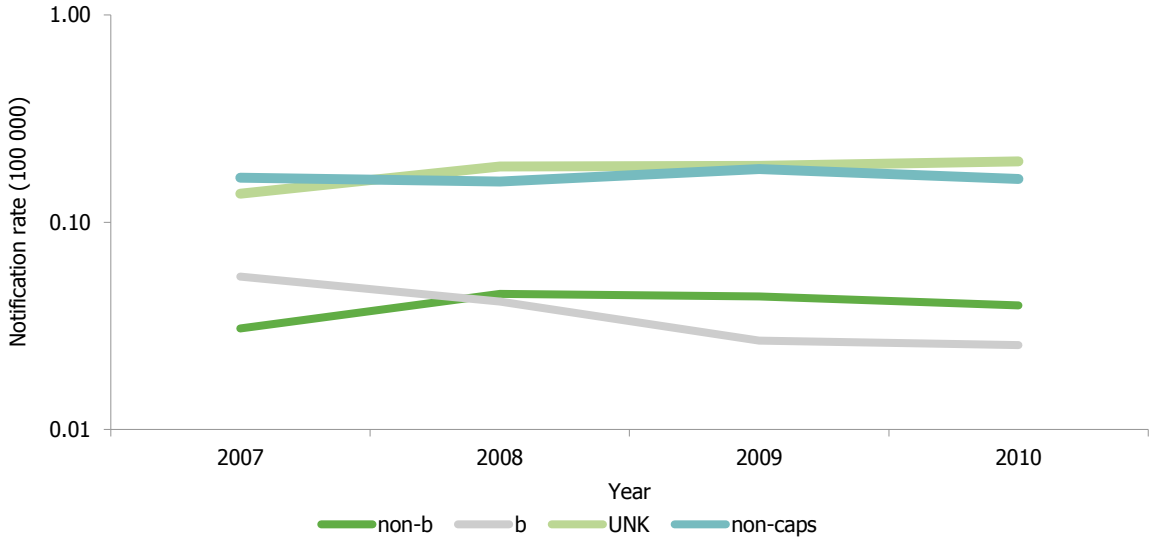
After the exclusion of serotypes reported as unknown, missing or not applicable, data on serotype was available in 43% (870) of cases for 2010. Non-capsulated serotypes accounted for 68% of cases, serotype b and non-b for 16% each respectively (Figure 4). Notification rates of serotype b disease declined between 2007 and 2010, and there are no indications of a serotype replacement of the vaccine-preventable type b with non-capsulated (non-typeable) b strains (Figure 5). For serotype distribution of reported invasive *H. influenzae* disease by country in known cases (Table A8, Annex 1.)

Figure 4. Serotype distribution of invasive *H. influenzae* disease, EU/EEA*, 2010 (n=870)**



Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.
Countries comments:
**Germany: At the time of report the technical implementation of matching the serotyping data has not been implemented yet.*
Netherlands: The numbers presented in report are only from HI type b and are most likely not complete, because notification just started.
***known serotypes*

Figure 5. Notification rates of invasive *Haemophilus influenzae* disease in EU and EEA countries with consistent reporting, by serotype and year, 2007–2010, semi-log scale (n=5 340)



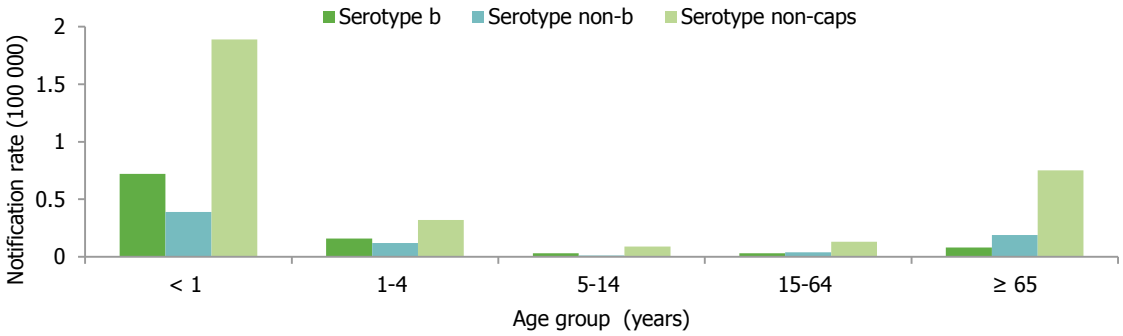
Contributing countries: Austria, Czech Republic, Denmark, Finland, Germany, Greece, Hungary, Ireland, Italy, Malta, Norway, Poland, Portugal, Slovenia, Sweden, and United Kingdom.

Non-capsulated strains accounted for the highest serotype-specific notification rates in all age groups, peaking in those aged less than one year (1.89/100 000) and 65 years and older (0.75) (Figure 6). Although since 2003, notification rates of serotype b disease have declined substantially (2008–2009 IBD report) in children below 15 years of age, serotype b still caused the second highest notification rates in this age group. In the age groups of 15 years and older, the notification rates of non-b serotypes were the second highest.

Regarding age distribution by serotypes, the unknown serotypes were the most frequently represented among the all age groups, with an average of 57%. Non-capsulated were commonly reported over all age groups, ranging between

27–33%, with the highest proportion (33%) in the age group 5–14. Serotypes b and non-b were rarely reported in the elderly. The highest proportions of b strains were reported in the age groups below one and 1–4 (15%), and the non-b strains were mainly notified the age group 1–4 (17%).

Figure 6. Notification rates of reported invasive *H. influenzae* disease serotypes, EU/EEA, 2010

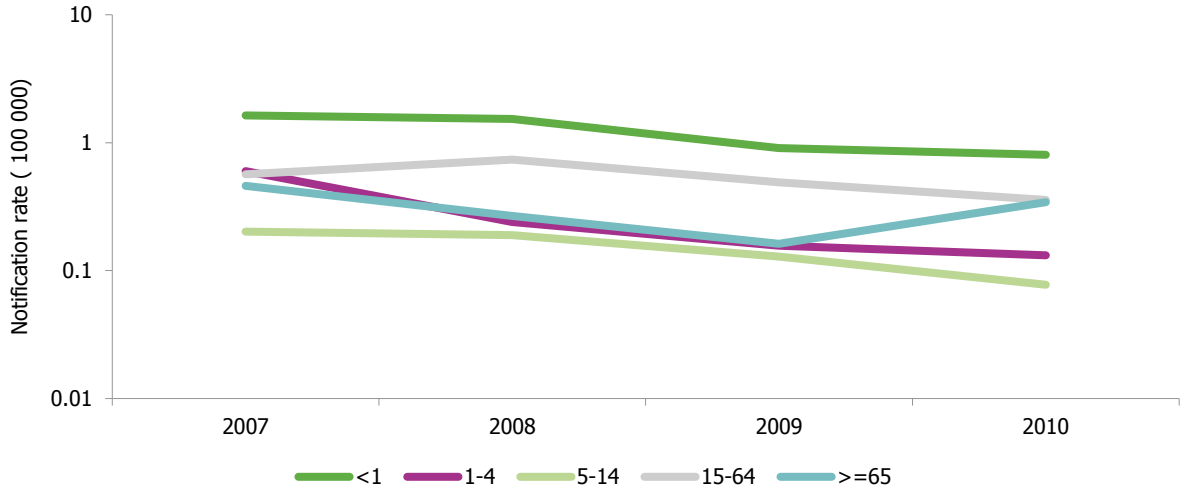


Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Sweden, United Kingdom

3.3.4.1 Serotype b strains

Between 2007 and 2010, infants below one year of age were the age group most affected by *H. influenzae* type b disease (Figure 7). Notification rates over this period showed a decreasing trend in all age groups except for those aged 65 years and older.

Figure 7. Notification rate (per 100 000 population) of invasive *H. influenzae* serotype b disease, by age group and year of reporting, EU/EEA, 2007–2010, semi log scale (n=472)



Contributing countries: Austria, Czech Republic, Denmark, Estonia, Finland, Greece, Ireland, Italy, Norway, Poland, Sweden and the United Kingdom.

The rate of invasive *H. influenzae serotype b* disease among <5-year-olds is used as the main indicator of the burden of disease. From 2008 to 2010, almost all countries reported notification rates <1 per 100 000 population in this age group, except for Lithuania and the Netherlands (Table 2, Table A9, Annex 1).

Table 2. Notification rate per 100 000 population and number of reported cases of invasive *H. influenzae* serotype b disease in children <5 years of age, by country and year, EU/EEA, 2008–2010

Country	2008 (n=34)	2009 (n=28)	2010 (n=42)
Austria	0.25 (1)	0.00(0)	0.25(1)
Czech Republic	0.19(1)	0.18(1)	0.00(0)
Denmark	0.61(2)	0.31(1)	0.00(0)
Estonia	0.00(0)	0.00(0)	0.00(0)
France**	0	0	(3)
Finland	0.34(1)	0.68(2)	0.00(0)
Greece	0.00(0)	0.36(2)	0.00(0)
Ireland	0.93 (3)	0.30(1)	0.00(0)
Italy	0.04(1)	0.04(1)	0.04(1)
Lithuania	1.30(2)	0.63(1)	0.00(0)
Netherlands*	0.00(0)	0.00(0)	1.41 (13)
Norway	0.34(1)	0.34(1)	0.00(0)
Poland	0.27(5)	0.32(6)	0.36 (7)
Romania	0.23 (2)	0.00 (0)	0.28 (3)
Slovakia	0.00(0)	0.37(1)	0.36(1)
Spain**	(1)	(1)	0
Sweden	0.00(0)	0.19(1)	0.91(5)
United Kingdom	0.63 (14)	0.25(9)	0.21(8)

**No data reported in 2008-2009 IBD Report*

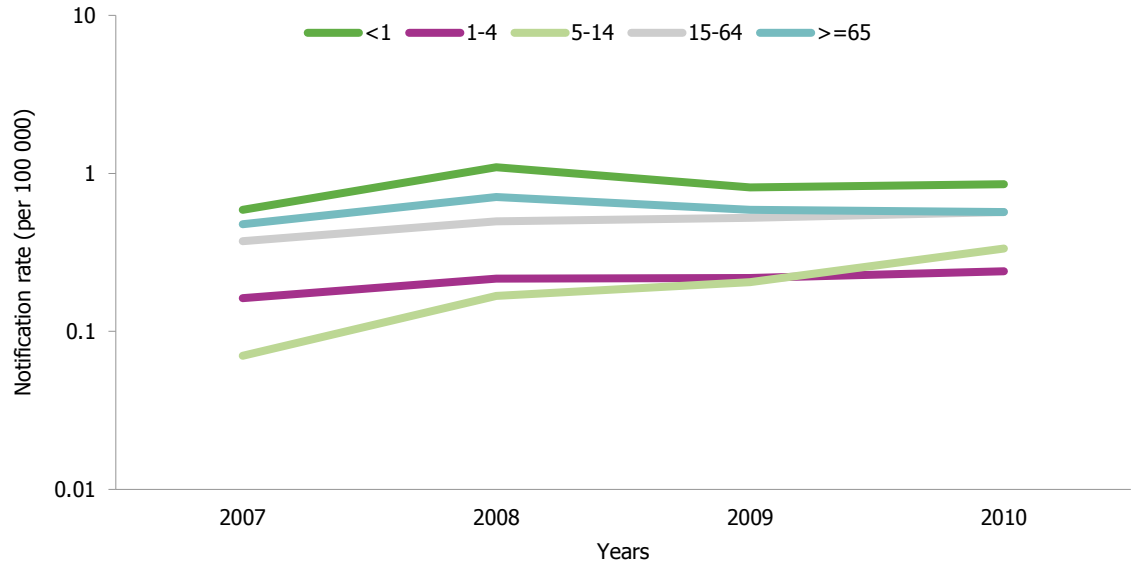
***Sentinel surveillance*

3.3.4.2 Non-type b strains

Between 2007 and 2010, notification rates of *H. influenzae* disease due to non-type b strains were mostly below 1 per 100 000 in each age group. However, over the years the trend appears to be on the rise in almost all age groups, but especially in the age group 5–14 (Figure 8). As in previous years, infants <1 year of age were the most affected in 2010, followed by those 65 years and older. The latter, accounted for most cases in absolute numbers (45%).

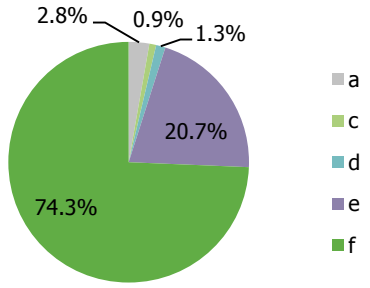
While Hib disease declined in Europe, *H. influenzae* e and f remained stable and dominated the distribution of non-b strains. As in previous years, serotypes e and f accounted for 95% of 1 196 non-b strains typed in 2010 (Figure 9).

Figure 8. Notification rate (100 000) of invasive *H. influenzae* non-b disease by age group, EU/EEA, 2007–2010, semi-log scale (n=510)



Contributing countries: Austria, Czech Republic, Denmark, Finland, Greece, Hungary, Ireland, Italy, Norway, Poland, Slovenia, Sweden and the United Kingdom.

Figure 9. Percentage distribution of non-b serotypes of invasive *H. influenzae* disease, EU/EEA, 2010



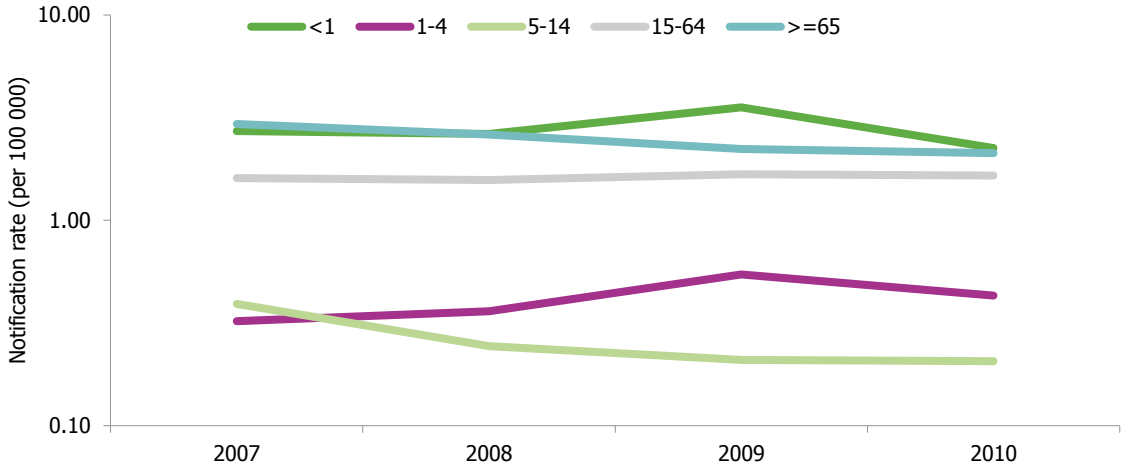
Contributing countries: Austria, Czech Republic, Denmark, Finland, Greece, Hungary, Ireland, Italy, Malta, Norway, Slovenia, Sweden and the United Kingdom.

3.3.4.3 Non-capsulated strains

Figure 10 shows the notification rates across age groups in 2007–2010 in countries reporting at least one strain, excluding b strains, over the studied period.

As in previous years, the highest rates of *H. influenzae* disease due to non-capsulated (non-typeable) strains occurred in infants <1 year of age in 2010, followed by ≥65 years-old (Figure 10). In both age groups, as well as between 5–14 years old, trends appear to be declining, whereas trends have been stable in the remaining age groups.

Figure 10. Notification rate (per 100 000 population) of invasive *H. influenzae* non-capsulated (non-typeable) disease by age group, EU/EEA, 2007-2010, semi-log scale (n=2 125)



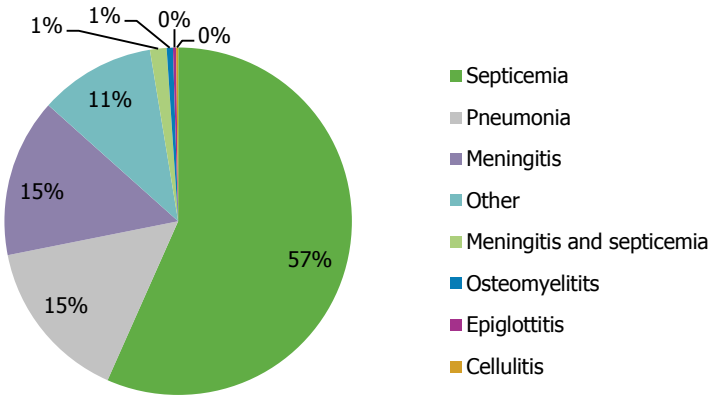
Contributing countries: Czech Republic, Denmark, Finland, Ireland, Italy, Norway, Poland, Portugal, Slovenia, Sweden and the United Kingdom.

3.3.5 Clinical presentation

Data on clinical presentation were available for 51% of reported cases. Septicaemia was the most common presentation, accounting for 57% of the cases. Meningitis and pneumonia were each reported in 15% of the cases (Figure 11). Country-specific data are displayed in Table A10. Percentage distribution of invasive *H. influenzae* disease cases by clinical presentation and country, EU/EEA, 2010

Comparing data with the previous year's report, the percentage of cases due to meningitis had decreased from 19% (2008–2009) to 15% in 2010, while septicaemia (57%) and pneumonia (15%) were responsible for a higher proportion of cases in 2010 than in previous years (55% and 13% respectively).

Figure 11. Percentage distribution of invasive *H. influenzae* disease cases by clinical presentation, EU/EEA, 2010 (n=1 031)



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

Taking into account cases with known clinical presentation and known age group, septicaemia (69%) was the most frequently reported clinical presentation among all age groups, followed by meningitis (15%) including all serotypes. Pneumonia was the third most frequently reported clinical presentation accounting for 10% of all clinical presentations (Table 3).

Table 3. Clinical presentation of invasive *H. influenzae* disease by age group, EU/EEA, 2010 (n=590)

Clinical Presentation	Age group										Total
	<1		1–4		5–14		15–64		65+		
	n	%	n	%	n	%	n	%	n	%	n
Meningitis	17	19.3	23	26.1	5	5.7	22	25.0	21	23.9	88
Septicaemia	41	10.0	24	5.9	10	2.5	144	35.3	189	46.3	408
Meningitis and septicaemia	3	25.0	1	8.3	1	8.3	5	41.7	2	16.7	12
Pneumonia	2	3.5	2	3.5	2	3.5	22	38.6	29	50.9	57
Osteomyelitis	0	0.0	0	0.0	1	33.3	1	33.3	1	33.3	3
Cellulitis	2	100.0	0	0.0	0	0.0	0	0.0	0	0.0	2
Epiglottitis	0	0.0	0	0.0	0	0.0	1	33.3	2	66.7	3
Other	0	0.0	2	11.8	3	17.6	7	41.2	5	29.4	17
Total	65	11.0	52	8.8	22	3.7	202	34.2	249	42.2	590

Regarding serotypes, in cases of Hib infection, meningitis, was reported as the most frequent (72%) clinical presentation in children below five and septicaemia in people over 14 years of age (77%), whereas non-b (85%) and non-capsulated (81%) were mainly responsible for septicaemia in adults. (Table A11, Annex 1). These findings were consistent with the previous year's findings.

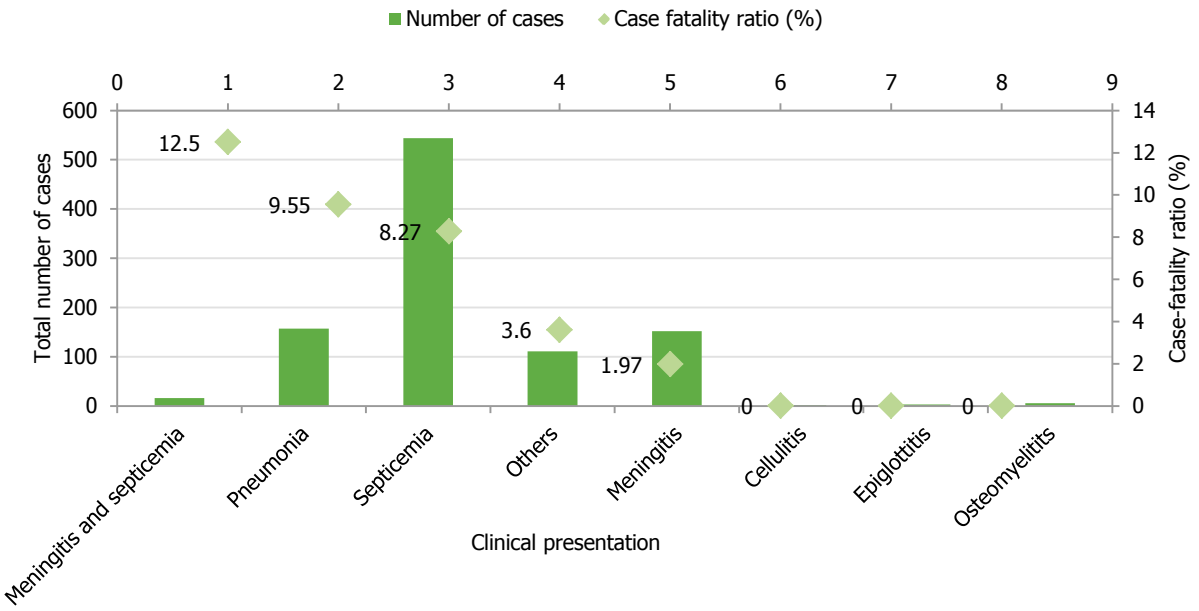
3.3.6 Case–fatality ratio

Outcome was reported in 50% of cases in 2010. The overall case–fatality ratio (CFR) of invasive *H. influenzae* was 5% (n=1 991). No deaths were reported from fifteen countries. The highest CFR was reported by Norway (14.6%), followed by Sweden (7.3).

The highest overall CFR was observed in non-b strains (8.0%), followed by non-capsulated (7.1%) and b strains (5.2%).

The CFR varied widely across clinical presentations (Figure 12). In 2010, meningitis and septicaemia (12.5%) was the leading cause of death from the disease, followed by pneumonia (9.6%) and septicaemia (8.3%). For country specific data (see Table A12, Table A13, Table A14, Annex 1).

Figure 12. Case–fatality ratio of invasive *H. influenzae* disease by clinical presentation, EU/EEA, 2010 (n=991)



3.3.7 Vaccination status

Vaccination status of Hib was reported for 137 cases (19%). In children below 15 years of age, unknown vaccination status accounted for 64 cases (47%) while 46 children (34%) were reported as not vaccinated and 20 (15%) as fully vaccinated (Table A15, Annex 1).For year of introduction of conjugate *H. influenzae* serotype b vaccination and childhood immunisation schedule in 2010 (see Table A16, Annex 1).

4 Results: invasive meningococcal disease

4.1 Data quality

The data completeness of the common set of variables (pathogen, age, month, classification, gender, outcome) was consistently very high (Table B3, Annex 2), and even slightly higher than in 2009. The data completeness of the enhanced set of variables ranged between 90% (Serogroup) and 19% (MLST result). Information on basic laboratory variables was available in the majority of cases; however, information on advanced laboratory methods for characterisation of *N. meningitidis* was only reported in up to 42.5% of the cases from up to 19 countries.

Among all reported variables, the completeness of reporting was the lowest for minimum inhibitory concentration (MIC) of different antibiotics. Vaccination status was reported in 31% of cases.

4.2 Laboratory methods used for diagnosis and strain characterisation

In 2010, culture remained the most frequent method used for diagnosis (51.4%), followed by PCR-based techniques (25.4%) (Table B4, Annex 2). PCR was used the most in Ireland (63%), the UK (51%), Greece (50%), Austria (47%) and Czech Republic (32%). Microscopy and antigen detection were used for diagnosis in 7.5% and 3% of cases, respectively. The use of geno-sequencing increased from 1% in 2008 and 1.5% in 2009 to 4% in 2010.

4.3 Epidemiological analysis

4.3.1 Overall notification rates

In 2010, 29 countries reported 3 819 cases of IMD, 3 710 (97%) of which were laboratory-confirmed with a notification rate of 0.7 per 100 000 population (Table B5, Annex 2). The rate has declined since 1999 (1.9 per 100 000).

Meningococcal disease appears to be rare in the majority of Member States, with notification rates ranging from 0.1 per 100 000 in Cyprus to 2.6 in Ireland (Figure 13. For the majority of countries with consistent reporting, the notification rate peaked between 2000 and 2003 and declined thereafter (Table 4).

Figure 13. Notification rate (per 100 000 population) of invasive meningococcal disease by country, EU/EEA, 2010 (n= 3 819)

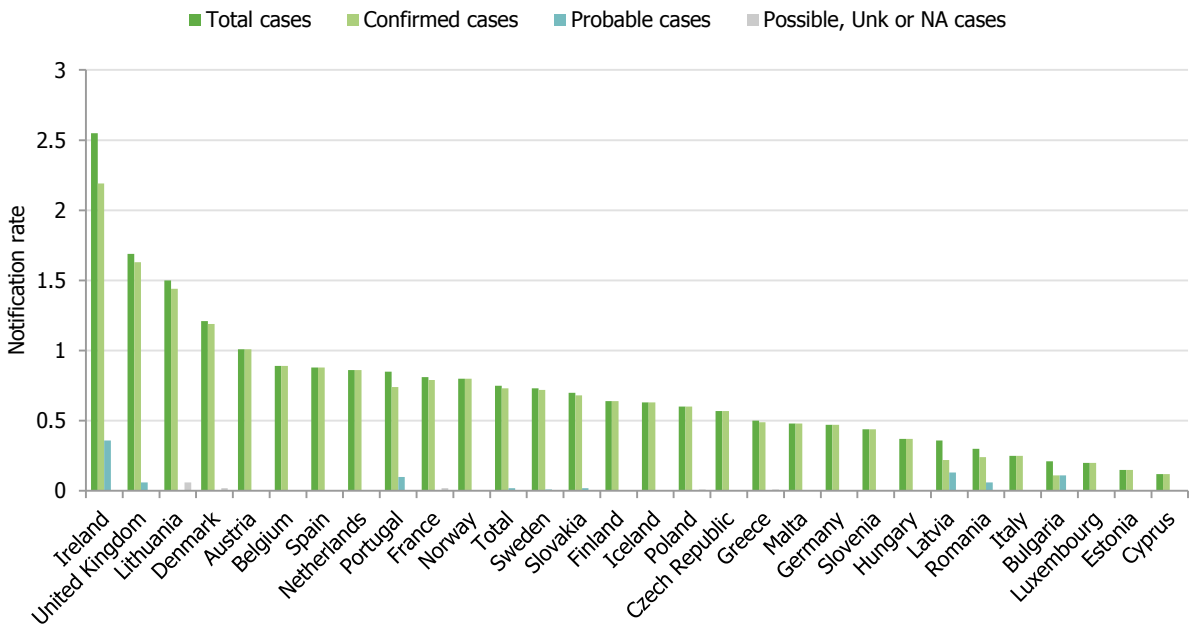


Table 4. Notification rates (per 100 000) and number of confirmed cases of invasive meningococcal disease by country, EU/EEA, 2000–2010[1]

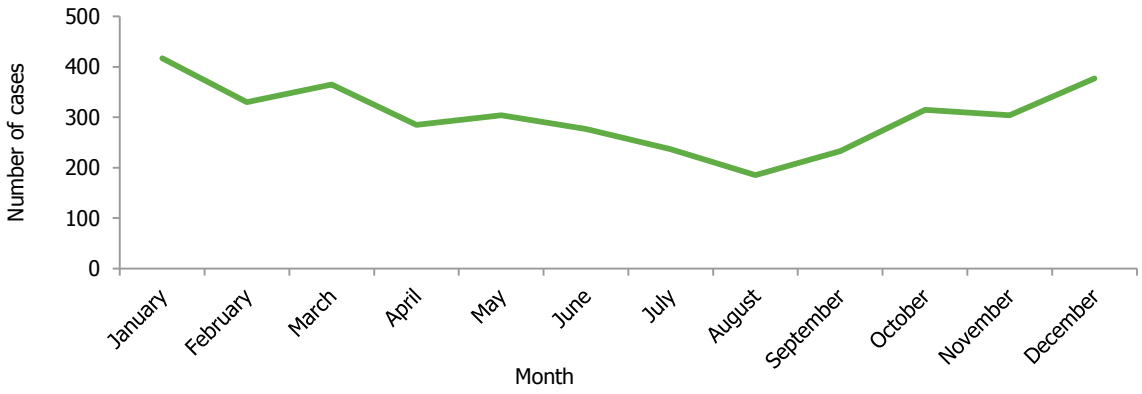
Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Austria	1.05 (85)	1.32 (107)	1.06 (86)	1.00 (82)	1.08 (88)	1.30 (106)	0.93 (76)	0.74 (69)	1.01 (84)	1.07 (89)	1.02 (85)
Belgium	2.60 (267)	3.69 (380)	2.54 (262)	2.20 (228)	1.51 (157)	1.63 (171)	1.32 (138)	1.49 (158)	1.03 (111)	0.97 (104)	0.89 (96)
Bulgaria	-	-	-	-	-	-	-	0.31 (24)	0.26 (20)	0.21 (16)	0.11 (8)
Cyprus	-	-	-	-	-	-	-	0.51 (4)	0.25 (2)	0.13 (1)	0.13 (1)
Czech Republic	0.72 (74)	1.06 (108)	1.20 (122)	0.98 (100)	1.03 (105)	0.95 (97)	0.77 (79)	0.73 (75)	0.79 (82)	0.76 (80)	0.57 (60)
Denmark	3.00 (160)	3.08 (165)	1.86 (100)	1.95 (105)	1.85 (100)	1.64 (89)	1.45 (79)	1.43 (78)	1.15 (68)	1.29 (71)	1.19 (66)
Estonia	0.80 (11)	1.61 (22)	0.73 (10)	0.74 (10)	0.81 (11)	0.96 (13)	0.82 (11)	0.82 (11)	0.45 (6)	0.37 (5)	0.15 (2)
Finland	0.93 (48)	0.98 (51)	0.94 (49)	0.81 (42)	0.86 (45)	0.77 (40)	0.86 (45)	0.81 (43)	0.55 (29)	0.62 (33)	0.64 (34)
France	0.81 (489)	0.92 (559)	1.11 (678)	1.31 (803)	1.13 (699)	1.19 (748)	1.13 (714)	1.07 (680)	1.05 (673)	0.95 (614)	0.79 (510)
Germany	0.55 (452)	0.95 (782)	0.89 (736)	0.94 (774)	0.73 (601)	0.76 (629)	0.67 (555)	0.53 (439)	0.55 (452)	0.60 (493)	0.47 (384)
Greece	2.39 (261)	2.14 (234)	2.12 (233)	1.19 (131)	0.65 (72)	0.88 (98)	1.02 (114)	0.95 (106)	0.70 (78)	0.68) (77)	0.49 (55)
Hungary	-	-	-	0.42 (43)	0.43 (43)	0.32 (32)	0.35 (35)	0.43 (43)	0.30 (30)	0.37 (37)	0.37 (37)
Ireland	13.59 (515)	8.58 (330)	6.49 (253)	5.96 (237)	4.92 (198)	4.91 (203)	4.97 (209)	3.76 (162)	3.45 (152)	3.01 (134)	2.19 (98)
Italy	0.44 (250)	0.36 (203)	0.39 (223)	0.48 (278)	0.55 (321)	0.56 (327)	0.30 (176)	0.30 (178)	0.30 (171)	0.30 (181)	0.25 (150)
Latvia	-	-	-	1.03 (24)	1.03 (24)	0.78 (18)	0.52 (12)	0.66 (15)	0.30 (6)	0.22 (5)	0.22 (5)
Lithuania	-	2.18 (76)	1.90 (66)	1.27 (44)	2.67 (92)	2.36 (81)	2.26 (77)	1.48 (50)	1.5 (68)	1.16 (39)	1.44 (48)
Luxembourg	0.23 (1)	0.23 (1)	0.23 (1)	0.45 (2)	0.00	0.22 (1)	-	0.42 (2)	0.41 (2)	0.61 (3)	0.20 (1)
Malta	7.92 (32)	5.11 (20)	3.55 (14)	4.53 (18)	3.00 (12)	2.48 (10)	8.90 (36)	1.47 (6)	0.73 (3)	1.21 (5)	0.48 (2)
Netherlands	3.42 (542)	4.51 (721)	3.82 (616)	2.19 (354)	1.75 (284)	1.51 (246)	1.09 (178)	1.19 (195)	0.98 (161)	0.91 (150)	0.86 (143)
Poland	0.11 (43)	0.10 (37)	0.09 (35)	0.15 (58)	0.31 (117)	0.52 (198)	0.43 (165)	0.88 (335)	0.84 (321)	0.79 (301)	0.60 (228)
Portugal	0.57 (59)	1.03 (106)	2.08 (216)	1.99 (208)	1.73 (182)	1.60 (169)	1.25 (132)	0.92 (98)	0.55 (58)	0.61 (65)	0.74 (79)
Romania	-	-	-	-	-	-	-	0.67 (145)	0.48 (104)	0.47 (102)	0.24 (52)
Slovakia	-	-	-	0.91 (49)	0.59 (32)	0.82 (44)	0.67 (36)	0.65 (35)	0.89 (48)	0.72 (39)	0.68 (37)
Slovenia	0.40 (8)	0.50 (10)	0.40 (8)	0.80 (16)	0.45 (9)	0.80 (16)	0.40 (8)	0.90 (18)	1.19 (24)	0.74 (15)	0.44 (9)
Spain	3.74 (1 499)	2.23 (904)	2.71 (1 109)	2.45 (1 019)	2.11 (892)	2.15 (923)	1.84 (800)	1.39 (620)	1.30 (581)	1.16 (533)	0.88 (404)
Sweden	0.46 (41)	0.64 (57)	0.53 (47)	0.63 (56)	0.65 (59)	0.63 (57)	0.57 (52)	0.54 (49)	0.53 (49)	0.70 (65)	0.72 (67)
United Kingdom	5.23 (3 067)	4.51 (2 655)	3.38 (2 004)	3.10 (1 848)	2.59 (1 549)	2.78 (1 672)	2.33 (1 401)	2.50 (1522)	2.21 (1 127)	1.93 (1 190)	1.63 (1 008)
Iceland	6.40 (18)	6.67 (19)	5.22 (15)	2.77 (8)	3.42 (10)	1.69 (5)	1.31 (4)	1.30 (4)	0.63 (2)	1.57 (5)	0.63 (2)
Liechtenstein	-	-	-	-	-	-	-	-	-	-	-
Norway	1.94 (87)	1.71 (77)	1.13 (51)	1.12 (51)	0.74 (34)	0.85 (39)	0.75 (35)	0.64 (30)	0.76 (36)	0.92 (44)	0.80 (39)
Total	1.85 (8 164)	1.69 (8 183)	1.54 (6 891)	1.38 (9 469)	1.21 (5 670)	1.26 (5 978)	1.10 (5 223)	1.04 (5 183)	0.93 (4 700)	0.89 (4 495)	0.73 (3 711)

[1] 1999–2006: source EU IBIS report. Population data derived from the Member States.
2007–2010: data source The European Surveillance System; Eurostat as population denominator source
"-": no data reported.

4.3.2 Seasonal trend

Information on seasonal distribution was available for 3 744 cases. IMD occurred throughout the year, peaking in the winter months and declining to low levels by late summer (Figure 14 and Table B6, Annex 2).

Figure 14. Number of reported invasive meningococcal disease cases per month*, EU/EEA, 2010 (n= 3 744)



*Contributing countries: Austria, Belgium, Bulgaria, 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, United Kingdom. *According to date used for statistics.*

4.3.3. Gender distribution

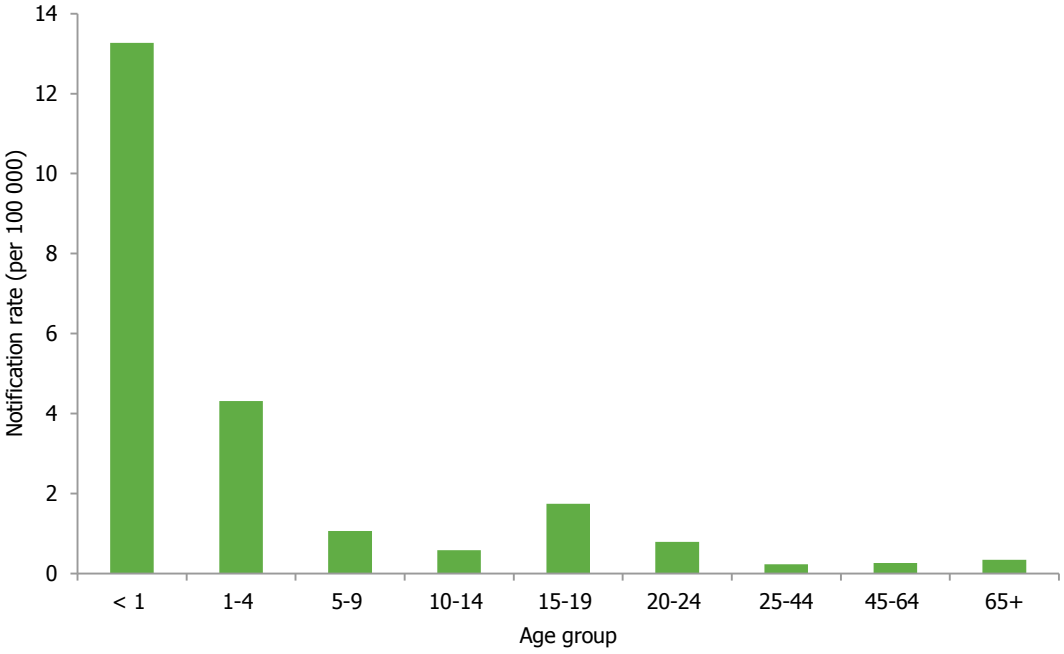
Information on gender was available for 3 783 cases (Table B3, Annex 2). Overall, males were slightly more affected by IMD than females, with a male-to-female ratio of 1.15 (Table B7, Annex 2). In seven countries, males were over-represented by at least 50%.

4.3.4 Age distribution

Information on age was available for 3 753 cases (Table B3, Annex 2), 50% of which were in children younger than 10 years.

The highest rates were notified in infants younger than one year (13.3 per 100 000 population), children aged 1-4 years (4.3) and adolescents aged 15–19 years (1.7) (Figure 15. Notification rate of invasive meningococcal disease per 100 000 population, by age group, EU/EEA, 2010 (n=1 443) and Table B8, Annex 2). Among the older age groups, the disease was only rarely reported.

Figure 15. Notification rate of invasive meningococcal disease per 100 000 population, by age group, EU/EEA, 2010 (n=1 443)



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

4.3.5 Probable country of infection

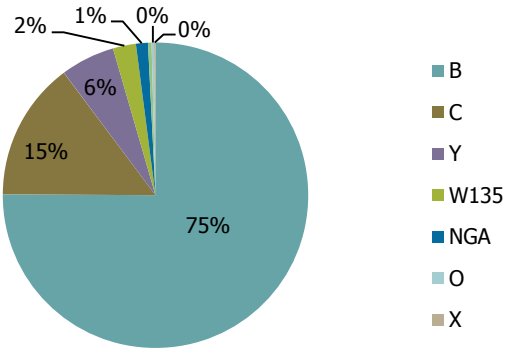
In 2010, six cases with known probable country of infection were reported as acquired outside the EU: one case in Albania (UNK serogroup), one case in Ukraine (serogroup C), two cases in Croatia (serogroup B), one in Morocco (serogroup B) and one in Thailand (serogroup B).

4.3.6 Serogroups

Serogroup distribution was 2711 (75%) for serogroup B, 531 (15%) for serogroup C, 211(6%) for serogroup Y and 89 (2%) for serogroup W135; 46 isolates were non-groupable and 13 isolates were serogroup A. (Figure 16).There was little annual variation for groups B and C in 2007–2010, but there was an increase of the proportion of serogroup Y from 3% in 2007 to 6% in 2010 (Table B9, Table B10, Annex 2).

The highest proportions of Y cases were reported in Finland (38%), Sweden (34%) and Norway (33%) (Table B10, Annex 2). In all other countries, serogroup Y accounted for 0% to 11% of cases. Serogroup A activity remains below 1% of the cases and was reported in Estonia, Portugal and Romania.

Figure 16. Percentage distribution of invasive meningococcal disease by known serogroup, EU/EEA, 2010 (n=3 620)

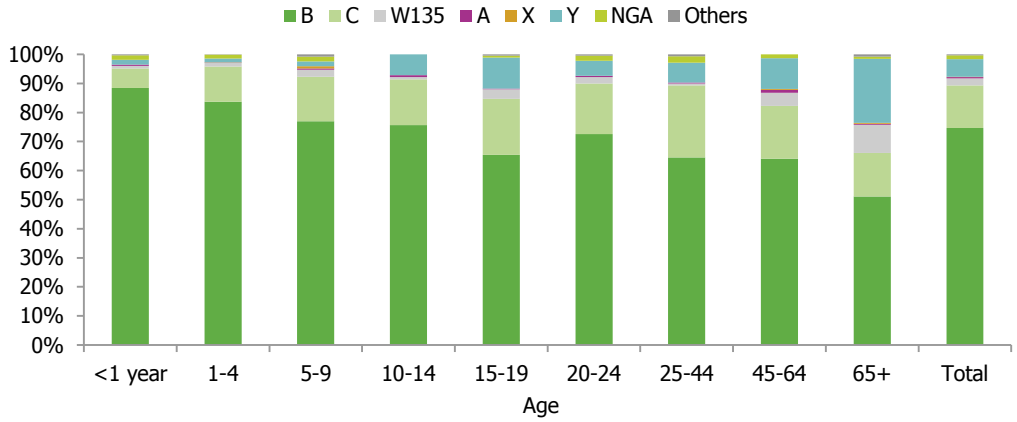


Contributing countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg , Malta, Netherlands , Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

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.

In infants younger than one year, 88% (n=573) of cases were due to serogroup B and 7% (n=44) to serogroup C. In children aged 1–4 years, 83% (n=684 of cases were due to serogoup B, and 12% (n=101 to serogroup C. Twenty-five percent of serogroup C cases were reported in young adults 25–44 (n=74 and 19% adolescents 15–19 years old (n=90) (Figure 17). Compared to previous years, a shift of serogroup C from adolescents to young adults is noticeable, however 58% of reported C cases remain in the age groups up to 19 years targeted by vaccination.

Figure 17. Percentage distribution of invasive meningococcal disease by known serogroup and known age group*, EU/EEA, 2010 (3 396)



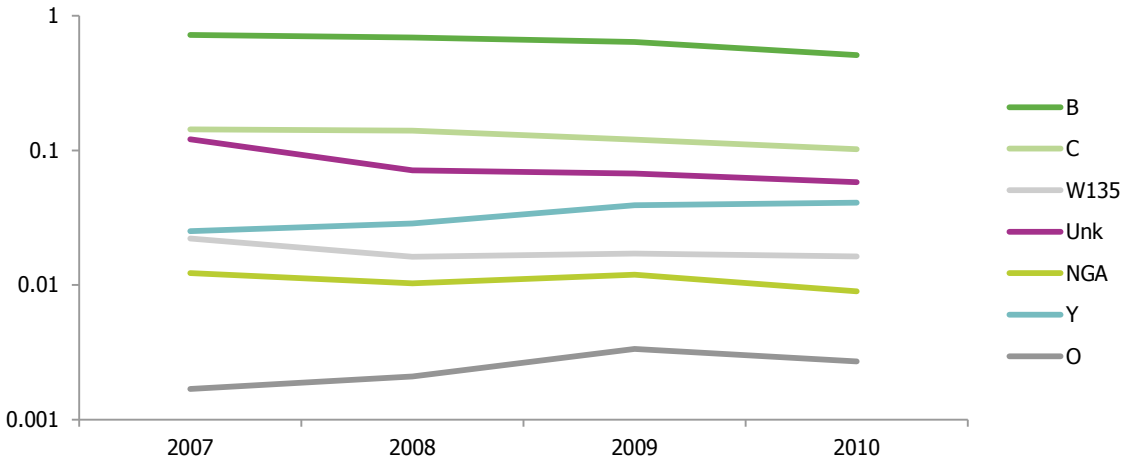
Contributing countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg , Malta, Netherlands , Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

NGA= non groupable; O = Others, are the remaining/other groupable serogroups that should be reported.

The notification rate of laboratory-diagnosed IMD by serogroup between 2007 and 2010 in countries consistently reporting at least one case of IMD in the studied period is shown in Figure 18. There was a decreasing trend over time, in almost all serogroups, especially in B and C. An increasing trend was shown in serogroup Y. The absolute numbers and rates for NGA and W135 remained relatively stable, while absolute numbers of reported cases due to serogroup Y slowly increased.

The data quality improved over the years with absolute numbers of cases with unknown serogroup decreasing between 2007 and 2010.

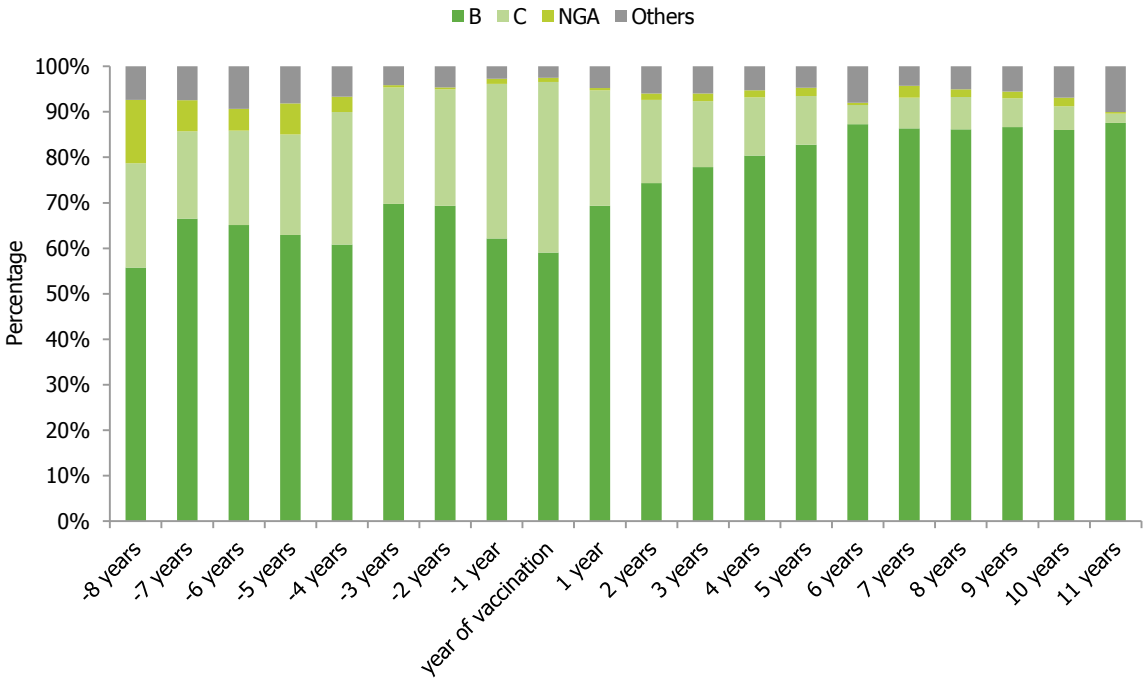
Figure 18. Notification rates of laboratory-diagnosed invasive meningococcal disease by serogroup in EU/EEA countries with consistent reporting, 2007–2010, semi-log scale (n=17 375)



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

Figure 19 highlights the impact of MCC vaccination, as the proportion of cases due to serogroup C markedly decreased in the years after the introduction of this vaccination. Between seven to eleven years following the introduction of MCC vaccination the percentage of other serogroups shows a slightly growing tendency.

Figure 19. Percentage distribution of invasive meningococcal disease by serogroup in MCC countries* in the years before and after the introduction of MCC vaccination into the routine vaccination schedule, 1999–2010 (n=56 385)**

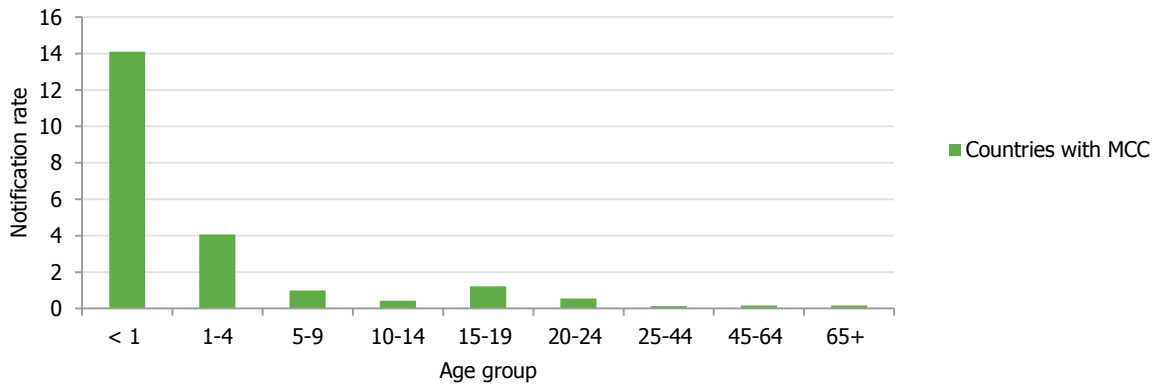


**Countries included as MCC countries: Belgium, Germany, Greece, Iceland, Italy, Ireland, Netherlands, Portugal, Spain and the United Kingdom **Source for vaccination schedules: EUVAC.NET 2010*

4.3.6.1 Serogroup B

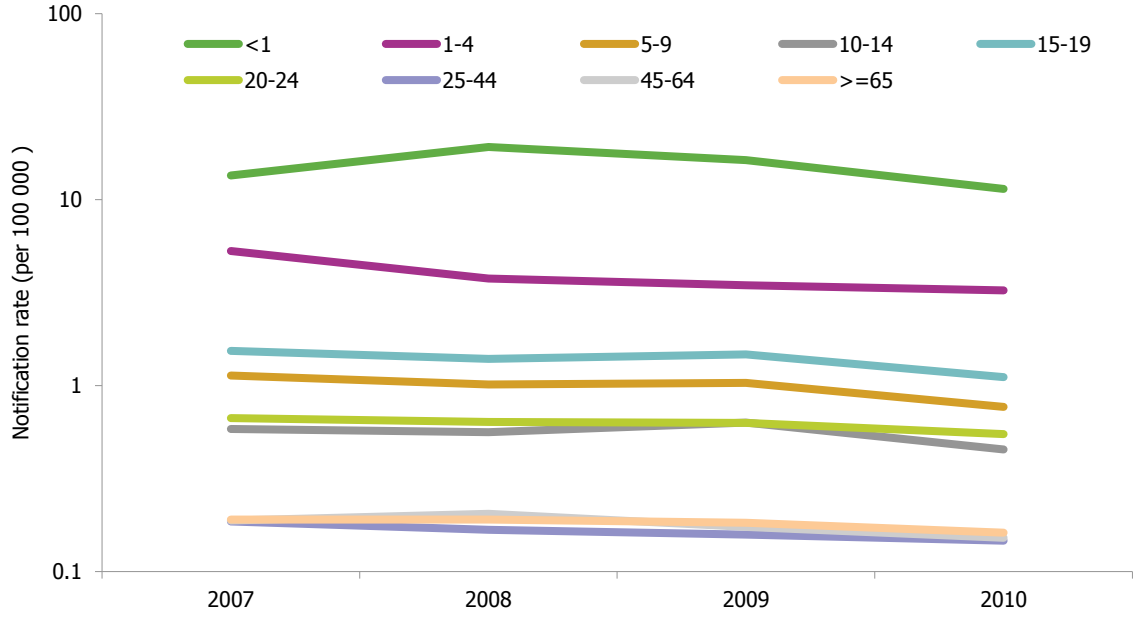
IMD in infants below one year (5.4 per 100 000) and in children younger than four years (1.6 per 100 000) was mainly related to serogroup B (Figure 20). Notification rates in adolescents 15–19 years old remained remarkably lower than in the younger age groups. Serogroup B disease was rarely reported among patients over 24 years of age. The notification rate of serogroup B cases by age group in countries with consistent reporting between 2007 and 2010 is illustrated in Figure 21. A decreasing trend was observed in all age groups, but especially in children under five years (for details see Table B11, Table B13, Annex 2).

Figure 20. Age-group-specific notification rates (per 100 000) of serogroup B invasive meningococcal disease cases, EU/EEA countries, 2010 (2 528)



Contributing countries: Austria, Belgium, 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 the United Kingdom.

Figure 21. Notification rate (per 100 000) of serogroup B invasive meningococcal disease by year and age group in countries with consistent reporting between 2007 and 2010, semi-log scale (n=12 166)



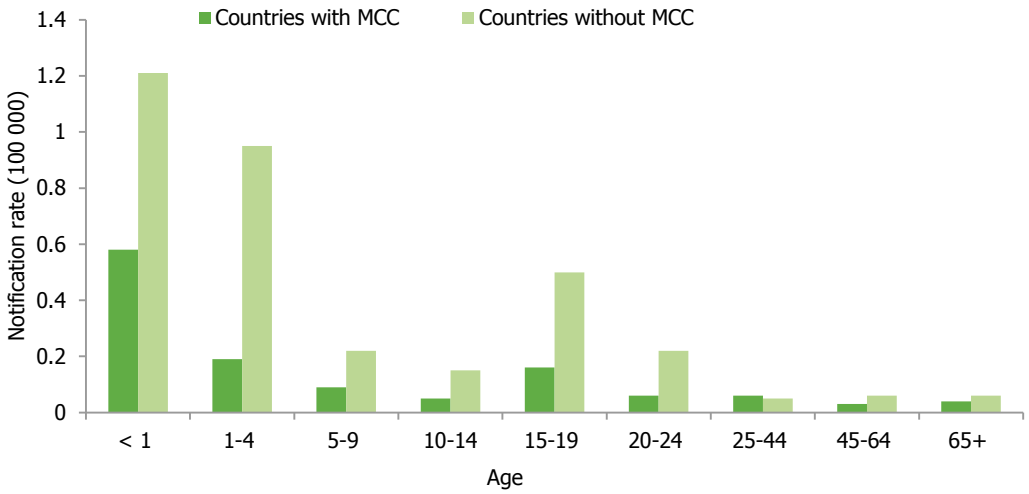
Population source: 2007–2010 Eurostat.
Contributing countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Malta, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

4.3.6.2 Serogroup C

Age group-specific notification rates of serogroup C disease by countries with and without MCC vaccination in 2010 are shown in Figure 22. Notification rates were highest in children below five years and in adolescents aged 15–19 years, and they were consistently higher in countries without MCC.

The notification rate of serogroup C cases by age group in countries with consistent reporting between 2007 and 2010 is illustrated in Figure 23. There was a decreasing trend in the age groups below 20 years. For details see Table B12 and Table B14, Annex 2.

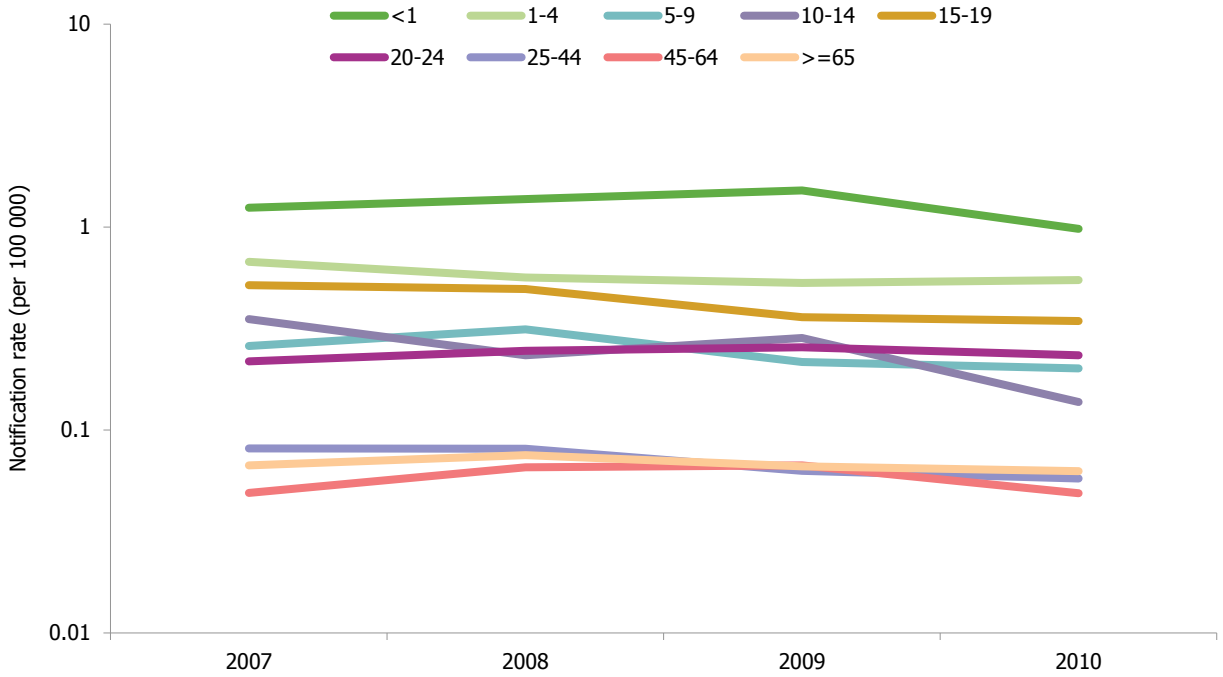
Figure 22. Age group-specific notification rates (per 100 000) of serogroup C invasive meningococcal disease in countries with and without MCC vaccination, EU/EEA, 2010 (n=498)



Countries with MCC: Belgium, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, United Kingdom

Countries without MCC: Austria, Czech Republic, Denmark, Finland, France, Hungary, Norway, Poland, Romania, Slovakia, Slovenia, Sweden

Figure 23. Notification rate (per 100 000) of serogroup C invasive meningococcal disease by year and age group in countries with consistent reporting, semi log scale 2007–2010 (n=2 404)



Population source: Eurostat; historical data were retrieved from the European Surveillance System database

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

4.3.7 Further characterisation of *N. meningitidis*

In 2010, 67 FetVR variants in 1 240 cases were reported by 16 countries (Table 5). Isolates of the variants F1-5 and F3-3 were the most frequently reported.

Table 5. Number and percentage distribution of FetVR variants in reported cases of invasive meningococcal disease, EU/EEA, 2010 (n=1 240)

Result FetVR	Number of cases (n)	Percentage (%)
F1-5	228	18.4
F3-3	220	17.7
F4-1	102	8.2
F3-6	94	7.6
F5-1	88	7.1
F5-5	83	6.7
F3-9	79	6.4
F1-7	75	6.0
F5-8	36	2.9
F5-2	34	2.7
F5-9	19	1.5
F5-12	17	1.4
F3-7	15	1.2
Others	150	12.1
Total	1 240	100.0

Reporting countries: Austria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain

Twelve countries reported 771 cases with known multilocus sequence type (Table 6). In line with findings in previous years, the bacterial population was highly diverse, comprising 24 different clonal complexes (CC): 24% of isolates belonged to CC ST-41/44, followed by CC ST-32 (17%) and CC ST-11 (13.5%).

ST-41/44 complex strains were responsible for 32% of B cases, while ST-11 complex strains were reported in 8% of cases with serogroup C disease (Table B15, Annex 2). For 75% of serogroup Y cases, ST-23 strains were responsible while 81% of serogroup W135 cases were due to ST22.

Table 6. Number and percentage distribution of MLST clonal complexes in reported cases of invasive meningococcal disease, EU/EEA, 2010 (n=771)

Sequence type	Number of cases (n)	Percentage (%)
ST-41/44	183	23.7
ST-32	129	16.7
ST-11	104	13.5
ST-269	84	10.9
ST-23	49	6.4
ST-213	45	5.8
ST-103	25	3.2
ST-162	25	3.2
ST-18	21	2.7
ST-461	20	2.6
ST-22	15	1.9
ST-60	15	1.9
ST-167	11	1.4
ST-334	9	1.2
ST-865	9	1.2
Others	27	3.5
Total	771	100.0

Reporting countries: Czech Republic, France, Germany, Greece, Hungary, Italy, Norway, Poland, Portugal, Slovakia, Spain, United Kingdom

Nineteen countries reported 49 PorA1 and almost 100 PorA2 variants in 1 704 and 1 697 cases of IMD, respectively. The most frequently reported PorA1 variants were 22, 7-2 and 5-1 (Table 7). The most prevalent PorA2 variants were 14, 4 and 16 (Table 8).

Table 7. Number and percentage distribution of PorA1 variants in reported cases of invasive meningococcal disease, EU/EEA, 2010 (n=1 704)

PorA1 variant	Number of cases (n)	Percentage (%)
22	290	17.0
7-2	239	14.0
5-1	201	11.8
5	157	9.2
7	156	9.2
18-1	124	7.3
5-2	105	6.2
19	94	5.5
19-1	49	2.9
21	46	2.7
Others	243	14.3
Total	1 704	100.0

Reporting countries: Austria, Czech Republic, Germany, Denmark, Finland, France, Greece, Hungary, Italy, Malta , Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Sweden, Spain, United Kingdom

Table 8. Number and percentage distribution of PorA2 variants in reported cases of invasive meningococcal disease, EU/EEA, 2010 (n=1 697)

ResultPorA2	Number of cases of cases (n)	Percentage (%)
14	204	12.0
4	194	11.4
16	171	10.1
2	142	8.4
10-8	117	6.9
9	98	5.8
10-1	87	5.1
3	86	5.1
15	74	4.4
1	50	2.9
Others	474	27.9
Total	1 697	100.0

Reporting countries: Austria, Czech Republic, Germany, Denmark, Finland, France, Greece, Hungary, Italy, Malta , Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Sweden, Spain, United Kingdom

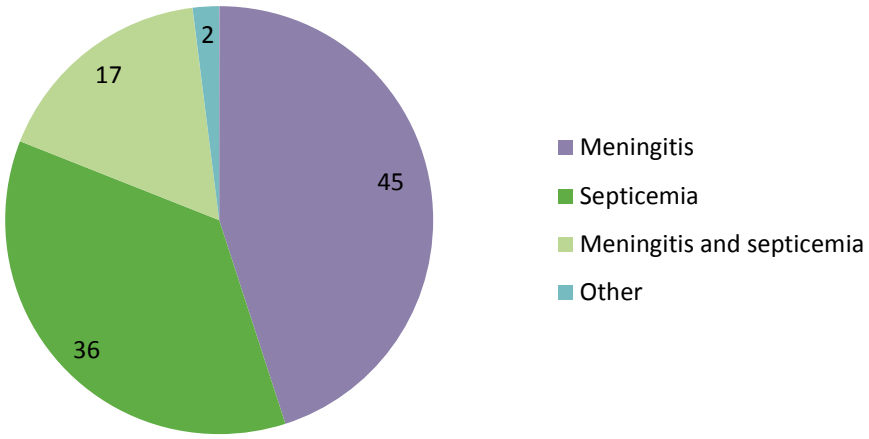
Antimicrobial susceptibility of isolates of *N. meningitidis*

The large majority of isolates tested in 2010 were susceptible to the antibiotics currently used for treatment and prophylaxis (rifampicin, cefotaxime/ceftriaxone, penicillin G, and ciprofloxacin). Two strains from Denmark and the UK were reported as resistant to Ciprofloxacin, 34 strains from nine countries as resistant to Penicillin, and six strains from Lithuania as resistant to Ceftriaxone.

4.3.8 Clinical presentation

In 2010, meningitis accounted for 62% of 1 854 cases with IMD and known clinical presentation, including 17% who also had septicaemia (Figure 24). In countries with more than 10 cases of IMD, proportions of septicaemia with or without meningitis ranged from 2.6% in Slovakia to 100% in Finland (Table B16, Annex 2).

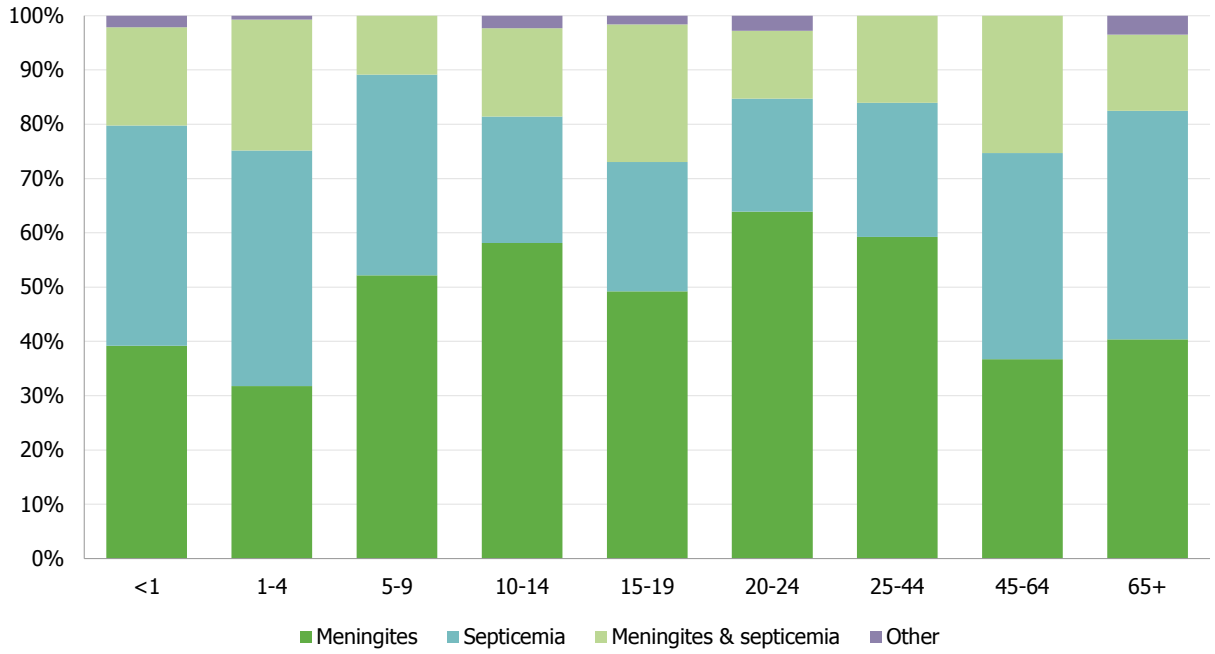
Figure 24. Percentage distribution (%) of clinical presentation of invasive meningococcal disease, EU/EEA, 2010 (n=1 854)



Contributing countries: Austria, Cyprus, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and the United Kingdom.

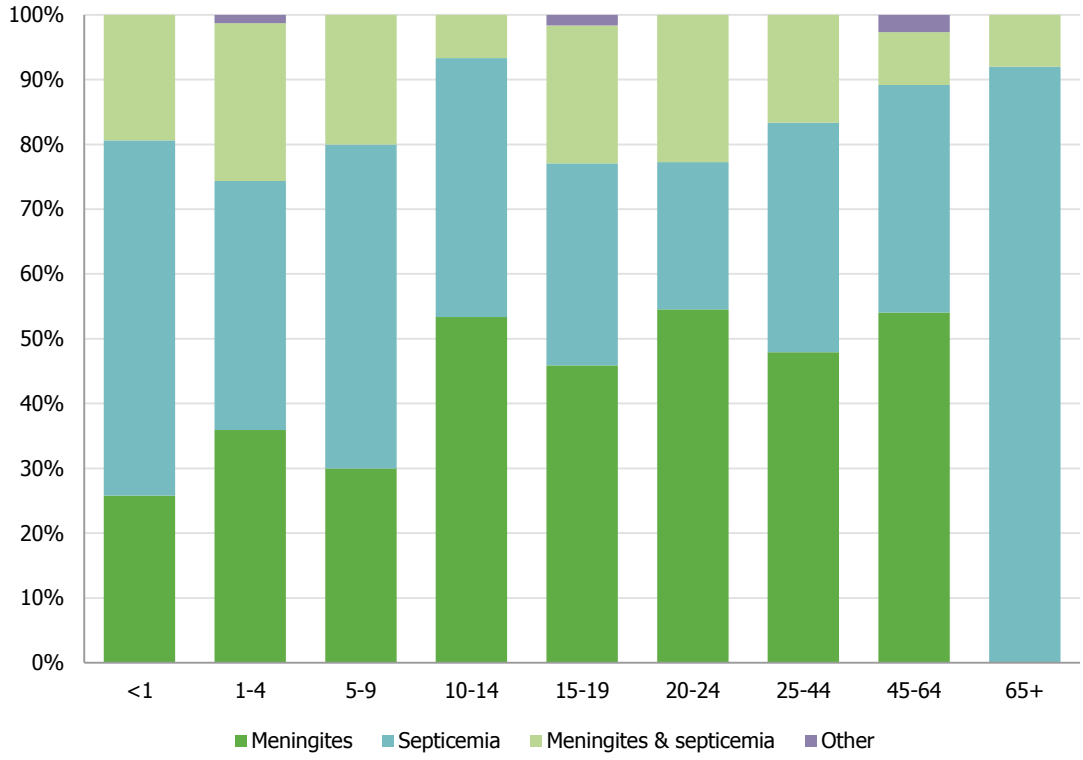
Among cases caused by serogroup B, meningitis was more frequently reported in adolescents and young adults whereas septicaemia was the most prevalent in infants and children younger than five years and in persons aged 65 years and older (Figure 25). A similar distribution was observed in serogroup C cases, but with septicaemia accounting for even higher proportions of cases in infants and persons in the oldest age group (Figure 26).

Figure 25. Percentage distribution (%) of clinical presentation of serogroup B invasive meningococcal disease by age group, EU/EEA, 2010 (n=1 056)



Countries reporting known B serogroup and clinical presentation: Austria, Cyprus Denmark, Estonia, Finland-Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, Poland, Portugal, Romania, Slovakia, Slovenia Spain and the United Kingdom.

Figure 26. Percentage distribution (%) of clinical presentation of serogroup C invasive meningococcal disease by age group, EU/EEA, 2010 (n=337)



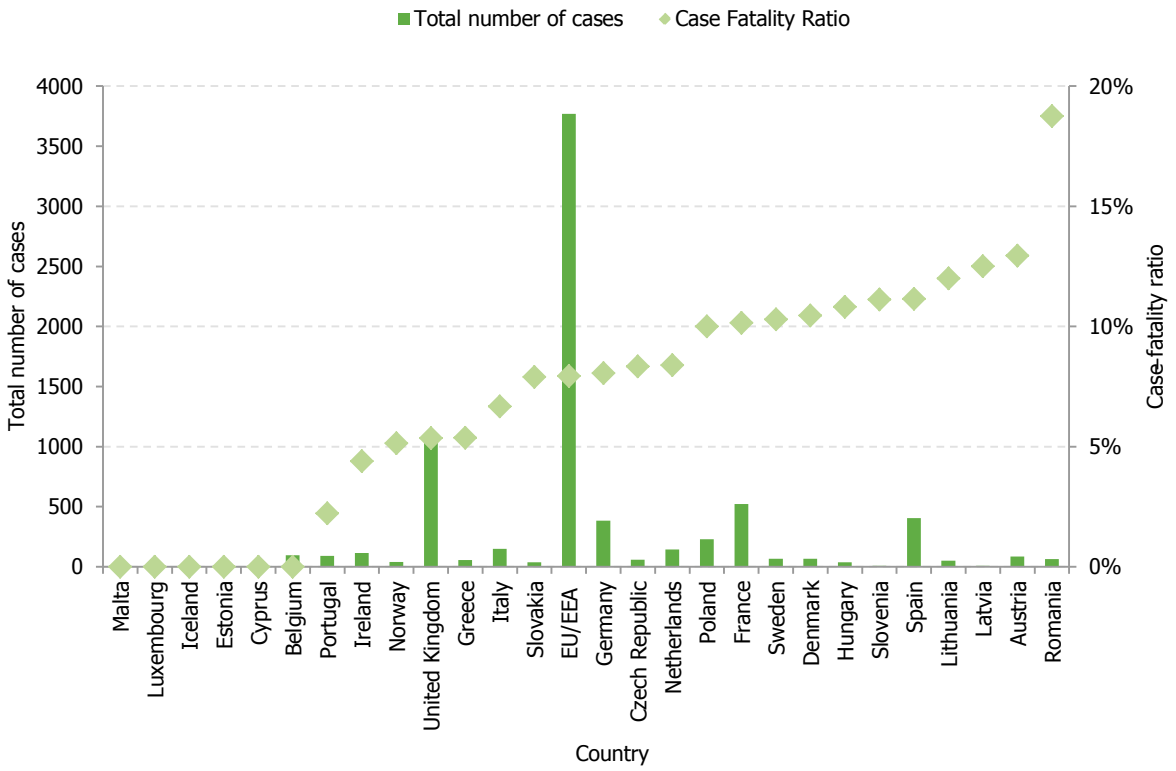
Countries reporting known C serogroup and clinical presentation: Austria, Denmark, Finland, Estonia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Norway, Poland, Portugal, Romania, Slovakia, Slovenia Spain and the United Kingdom.

4.3.9 Case–fatality ratio

Of 3 769 cases of IMD with known outcome, 299 (7.9%) were reported to have died in 2010. Country-specific CFRs ranged from 0 in Cyprus, Estonia, Iceland, Luxembourg and Malta to 18.8% in Romania (Figure 27 and Table B17, Annex 2).

The overall CFR in 2010 was within the range of values observed in the previous four years (7.7–8.5%).

Figure 27. Number of cases of invasive meningococcal disease cases and case–fatality ratio, by country, EU/EEA, 2010 (n=3 769)



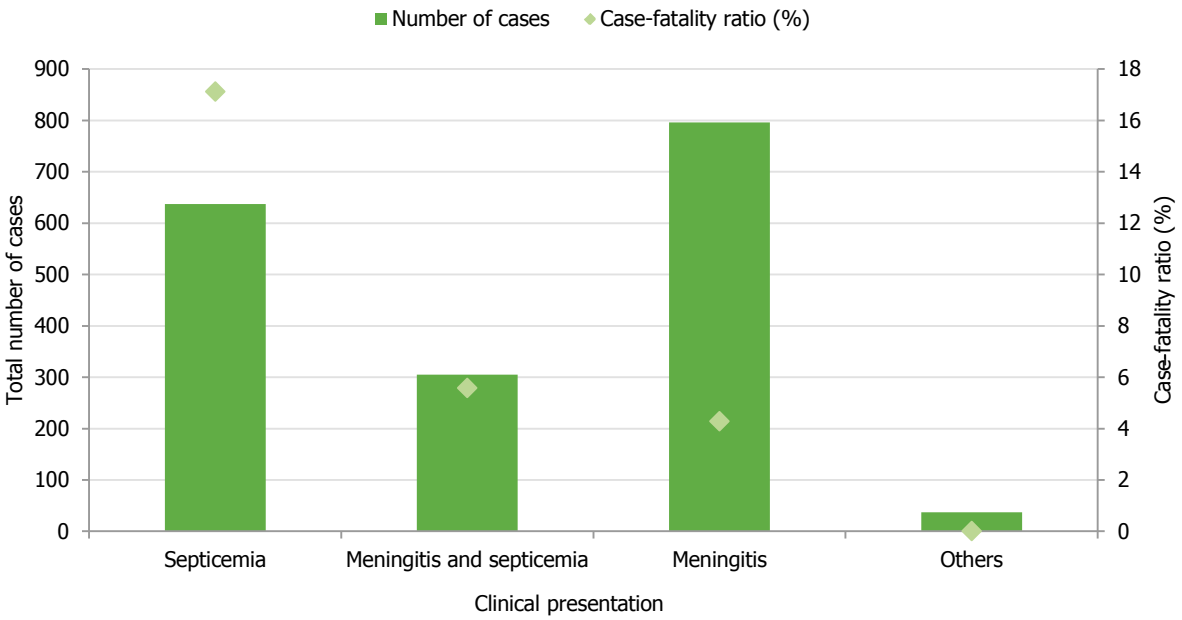
While the highest number of deaths was reported for serogroup B IMD (n=164), the highest CFR was found in cases with non-groupable neisseriae (17.4%), followed by serogroups A (15.4%) and C (13.0%) (Figure 28 and Table B18, Annex 2).

Figure 28. Serogroup-specific case–fatality ratio of confirmed invasive meningococcal disease cases, EU/EEA, 2010 (n=3 620*)

Contributing countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.
**Number of cases with known serogroup*

The highest CFR was found among cases reported with septicaemia without meningitis (17.1%) (Figure 29), and it was four times the CFR of meningitis with septicaemia (4.3%).

Figure 29.Case–fatality ratio of invasive meningococcal disease by clinical presentation, EU/EEA, 2010 (n=1 775*)



Contributing countries: Austria, Cyprus, Germany, Denmark, Estonia, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and the United Kingdom.

**Cases with known clinical presentation*

The MLS type CC-32 accounted for the majority of deaths in the EU/EEA, closely followed by CC-11. ST 334 proved to be the most severe with a CFR of 33% (Table 9).

Table 9. Case–fatality ratio of invasive meningococcal disease by clonal complex, EU/EEA, 2010

Result MLST	Death (n)	Cases (n)	CFR %
ST-41/44	9	183	4.9
ST-32	18	129	14.0
ST-11	12	104	11.5
ST-269	6	84	7.1
ST-23	5	49	10.2
ST-213	4	44	9.1
ST-103	0	25	0.0
ST-162	1	25	4.0
ST-18	4	21	19.0
ST-461	1	20	5.0
ST-60	3	15	20.0
ST-22	2	15	13.3
ST-167	2	11	18.2
ST-334	3	9	33.3
ST-865	1	9	11.1

4.3.10 Vaccination status

Of the 531 cases with relevant information, 56% were reported with unknown vaccination status and 41% as unvaccinated. A small proportion of 13 notified serogroup C cases were reported as fully vaccinated (2.5%) or partly vaccinated (1%). For details see Table B19 and B20, Annex 2.

5 Discussions

5.1 Case definitions

The EU case definition for both diseases has been modified slightly twice over the past few years. In 2010, the majority of countries reported that they applied the 2008 version of the EU case definition. 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 invasive *H. influenzae* disease or invasive meningococcal disease in both case definitions are identical or almost identical, respectively, and probable cases for IMD only accounted for 3% of all cases.

5.2 Data sources

National surveillance systems for both diseases are heterogeneous in Europe. Most data come from comprehensive surveillance systems, but there are differences in terms of age groups under surveillance, sensitivity, availability of laboratory methods used for case confirmation, data completeness and consistency. In the majority of countries, epidemiological and laboratory data are merged at national level, but there are some countries where this is still not possible. These differences between national surveillance systems hamper comparisons between Member States. In addition, changes in surveillance systems and improved case ascertainment complicate the analysis of data over time, even within countries. Therefore, any spatial findings or temporal trends need to be interpreted with appropriate caution.

5.3 Laboratory methods

For both diseases, 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 this is encouraging, routine use of these techniques for strain characterisation still appears to be limited in the majority of Member States. On the other hand, feedback from a number of Member States indicated that the reporting instructions may have been interpreted too restrictively in some instances. Hence, it is possible that instead of reporting all diagnostic methods used, data providers only reported the test method used on the first specimen, leading to under-reporting of subsequent typing results.

5.4 Completeness of surveillance data

The completeness of reporting varied between variables and across countries, however the completeness has improved consistently and in 2010 there was no variable reported as 100% unknown. Information on basic laboratory variables were reported in almost all Member States however, further information on enhanced variables or on advanced laboratory methods for the diagnosis was reported by a limited number of countries.

Several lessons were learned and further revision of the metadata-set will be carried out. This may include a removal or change of certain variables, changes/additions in codes of the variables, and development of further automatic validation rules when uploading the data.

5.5 Epidemiology of invasive *H. influenzae* disease

5.5.1 Overall notification rates

In EU/EEA countries, invasive *H. influenzae* disease has become a rare disease with an overall notification rate of 0.43 per 100 000 population. As in 2007–2009, higher rates were observed in North-Western Europe, possibly due to better case ascertainment and reporting.

H. influenzae type b has been a major cause of morbidity and mortality prior to the introduction of conjugate vaccines. However, since their inclusion in routine childhood vaccination programmes, invasive *H. influenzae* type b disease has substantially decreased in Europe.

Comparisons of absolute number and rates between and within countries should be done with caution as specific characteristics of the national surveillance systems and its level of sensitivity may vary.

Trends should also be analysed with caution as various changes in the surveillance methods occurred over the years; availability of new laboratory methodologies; comprehensiveness of the system; expansion of age groups; and serotypes and syndromes under surveillance. Taking into account the above listed improvements of the surveillance systems and to render a European picture, the inclusion criteria of countries was changed in 2010 by extension the list of countries included in the analysis. However the main findings were similar with the previous year's findings.

5.5.2 Age distribution

Hib vaccination led to a significant decrease in invasive bacterial infections in children. Yet, although the age group of ≥ 65 years was the most affected group in terms of absolute numbers, the highest notification rate of Hib disease was still reported among infants < 1 year of age.

This could be explained by vaccine failure, vaccine shortage or infants too young to be vaccinated. Another explanation is that the disease in the youngest age group was caused mainly by non-capsulated serotype, not covered by vaccination.

5.5.3 Serotypes

Overall, serotype b is continuing to decrease in Europe with a notification rate below 0.1 per 100 000 population in 2010. Likely to be a direct result of vaccination against Hib disease, this decreasing trend was observed in almost all age groups, but most strikingly in children below five years of age.

At the same time, European surveillance data show increasing numbers of non-capsulated and non-b serotypes, affecting mainly infants and the elderly. Among non-b serotypes, f was the one most commonly isolated. Similar finding were published elsewhere [1,3-5]. There have been some concerns about replacement of *H. influenzae* serotype b in populations where the conjugated *H. influenzae* type b vaccines have been introduced [4]. Others have not found any convincing evidence of serotype replacement [6].

In a number of countries, 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. There are serotype available data in Germany, and the technical implementation of matching the data is in progress.

5.5.4 Clinical presentation

Clinical presentation is known to be associated with different serotypes and strongly related to age [7,8]. As in previous years, the majority of cases suffered from septicaemia and were mostly over 14 years old.

The proportion of pneumonia increased from 3% to 28%, affecting especially those aged 65 and older. This percentage could be even higher, since in some countries, only *Haemophilus* meningitis is under surveillance. In the United States, pneumonia was the most frequent clinical syndrome reported [9], and the sudden increase in Europe may have been due to a heightened awareness of this clinical manifestation[10].

5.5.5 Case–fatality ratio

The overall CFR in 2010 was 5% which is similar to the 6% observed in 2008 and 2009. The CFR is reported to have decreased since the nineties (9%), using the same approach as this report to calculate the CFR [3,9] .

While most European cases of invasive *H. influenzae* disease are attributable to non-capsulated strains, non-b strains caused the highest case fatality (9%). In a recent study from the UK, non-capsulated strains were associated with the highest CFR [11].

5.5.6 Vaccination status

The highest proportion of fully vaccinated Hib cases was observed in the age groups 1–4 and 5–14 years, whereas for most cases older than 14, the vaccination status was reported as unknown.

About half of the cases in infants below one year were not vaccinated against Hib, probably due to disease onset before administering the first vaccine dose.

5.6 Epidemiology of invasive meningococcal disease

5.6.1 Overall notification rates

IMD remains rare in Europe and the recent data show a continued decreasing tendency, with notification rates in most countries below 1 per 100 000 population. A notification rate of less than 0.5 per 100 000 was registered in 11 countries in 2010.

The incidence of IMD varies ten-fold between EU/EEA Member States. This variation might reflect real differences, but might also be partly due to differences between disease surveillance systems in Member States. An in-depth explanation would require a better understanding of the data sources and a better knowledge of laboratory practices and logistics (blood culture sampling, timeliness of sample transportation, 7/24 duty) at Member State level [12,13].

An overall IMD notification rate of 0.75 per 100 000 population in 2010 represents an important decline compared to the rates reported 10 years ago. Several countries have introduced MCC vaccination in their national immunisation programmes, and even people who are not vaccinated are protected [14].

5.6.2 Age distribution

As in previous years, the highest notification rates of IMD were observed among children younger than five years and there was a secondary peak in adolescents aged 15–19 years.

The proportion of B cases decreases while the proportion of C and Y cases increases with age. C is observed the most among teenagers and young adults. This could be explained probably due to a combination of lower vaccination uptake and waning immunity [15] [14,16].

5.6.3 Serogroup

Serogroup data completeness has improved from past years, reaching values of over 90%. In Europe, about 90% of IMD was caused by serogroup B and C in 2010, and the distribution of serogroups varied considerably between countries, probably partly depending on whether routine MCC vaccination had been introduced. The dominance of B and C diseases has also been described elsewhere [17] . Likewise, the overall decrease in IMD notification rates seen over the past years has been primarily due to serogroups B and C. A decrease in IMD due to serogroups B and C over the last 20 years was also reported from the U.S., although the reasons for these trends remain unclear[18].

In line with our findings, recently published epidemiological data indicate an increase of serogroup Y IMD in some parts of Europe [15,16,19] and the U.S., where serogroup Y accounts for rather high percentage of notified IMD cases [18]. ECDC currently has no complete overview of the surveillance of serogroup Y in place in the Member States However, increasing quality of surveillance and availability of molecular typing methods should eventually also lead to improved characterisation of serogroup Y isolates in Europe.

Serogroup A has largely disappeared from Europe; however sporadic cases are still reported. While in the U.S., serogroup A cases tend to be imported [17,20], this serogroup seems to persist especially in eastern parts of Europe.

5.6.4 Molecular typing data

Although the bacterial population found in IMD patients in 2010 was highly diverse, three main clones seem responsible for severe IMD in Europe, and they are associated with certain serogroups. The hyperinvasive ST41/44 clonal complex dominated the population of serogroup B neisseriae. This strain is known to be associated with serogroup B [17,21-23].

Molecular surveillance helps to better understand the epidemiology of IMD and the importance of developing an effective B vaccine, but it currently only covers few countries. The more Member States who participate, the more robust the findings will be.

5.6.5 Clinical presentation

Meningococcal meningitis was the most commonly reported clinical presentation of IMD, occurring mainly in adolescents and young adults and peaking in those aged 20–24 years. Septicaemia mainly affected children younger than five years of age and persons aged 65 and older. The distribution of meningitis and septicaemia hardly differed between serogroups B and C, probably largely dependent on clinical and surveillance practice. 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.

5.6.6 Case–fatality ratio

The case–fatality ratio is an important measure of the virulence of *N. meningitidis* and the effectiveness of treatment. The overall case–fatality ratio was 7.9% and ranged between 2 and 18% in the Member States. Similar results were reported over the years in Europe and the U.S. [24] [25].

A high CFR in countries with low notification rates may indicate a bias in their data towards reporting the most severe cases. A low CFR in countries with high notification rates may in turn reflect a situation where deaths were occurring after the disease was notified. Outcome data accuracy might also be influenced by the surveillance system: 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.

5.6.7 Vaccination

The Committee for Medicinal Products for Human Use (CHMP) granted a marketing authorisation valid throughout the European Union for meningococcal group-B vaccine (rDNA, component, adsorbed) on 14 January 2013[1]. The vaccine was found to have the potential to reduce serogroup B IMD substantially. Despite its potential, the vaccine may have some limitations, and it remains to be seen if booster doses will be required to sustain protection. However, for the first time, vaccines to prevent the five serogroups causing most IMD in infants and toddlers became available. [26].

[1] European Medicines Agency. EPAR Summary for the Public. 2013. Available here: http://www.ema.europa.eu/docs/en_GB/document_library/EPAR_-_Summary_for_the_public/human/002333/WC500137857.pdf

6 Conclusions

In summary, although the surveillance systems for invasive bacterial diseases continue to be very diverse across Europe and case definitions differ for some countries, certain trends in incidence and serogroup distribution can be deduced from the data provided:

- Data completeness is improving, but still fairly low for the enhanced set of variables.
- IMD remains rare in Europe, with a decrease in notification rate by over 60% compared to 1999.
- Infants and children suffer the highest rates of IMD.
- Serogroup B causes the majority of IMD.
- In countries with MCC, the proportion of IMD cases due to serogroup C is lower than in countries without MCC vaccination
- *H. influenzae* disease was predominantly found in infants and in the age group of 65 years and older.
- *H. influenzae* b notifications are steadily decreasing.
- The age groups most affected by *H. influenzae* serotype b were still children below five years of age.
- Non-capsulated and non-b *H. influenzae* were the most frequently reported serotypes.
- Despite the yearly variations of non-capsulated and non-b notification rates, their trend line is slightly increasing.

The standardisation of IBD surveillance data across Europe has improved and should continue to improve. Better understanding of surveillance systems and laboratory practices in different Member States will help the interpretation of results. Continued reporting on serotypes/serogroups and monitoring the trend is important for identifying age groups at increasing risk. Better linkage between notification and laboratory data at national level would provide stronger data. A particular focus should be given to more complete reporting of serogroup Y IMD to monitor the observed increasing trend over time. IMD cases due to serogroup C need to be followed up more closely, especially in countries with MCC vaccination to identify any cases due to waning immunity. More reliable information on circulating epidemic clones in Europe is possible once genotyping data is made more available by the Member States. Finally for better data comparability between countries, the use of the 2008 EU case definitions for surveillance purposes is strongly encouraged.

In order to identify groups that might be susceptible to infection, it is important to complement high-quality disease surveillance with seroprevalence studies of serogroup C.

7 Limitations

- A limited number of European countries have the facilities for molecular typing invasive strains from all cases. In 2010, 12 countries reported multilocus sequence typing results. In this report, due to low data availability, it was not possible to analyse these results in depth.
- Too many influencing factors may bias the *Haemophilus influenzae* serotype data and, as such, do not allow any inference to be made with confidence. These factors are: inconsistent reporting, the low completeness of reported serotypes among reporting countries and the small sample of countries with consistent surveillance of serotypes.
- It was not possible to analyse in-depth primary or secondary vaccine failures because the data completeness for vaccination status was relatively low (31%), and no enhanced dataset on vaccination status (availability of type of vaccine, number of doses received, period interval between doses and date of the last dose) and risk factors of vaccine failure was collected.
- It was not possible to interpret the results in terms of vaccine shortage, since no such information was available.
- Since no population data by age in months was available, we were not able to analyse notification rates below one year of age.
- Comparisons of absolute number and rates between countries should be made with caution as specific characteristics of the national surveillance systems may vary.
- Caution must also be taken when analysing trends as various changes in the surveillance methods occurred over the years: availability of new laboratory methods; comprehensiveness of the system; extension of age groups; a broader coverage of serogroup/serotypes and clinical forms of the disease under surveillance.
- In small countries, small changes in numbers may cause large differences in rates and ratios.

References

1. Ladhani SN. Two decades of experience with the haemophilus influenzae serotype b conjugate vaccine in the united kingdom. Clin Ther. 2012 Feb;34(2):385-99. PubMed PMID: 22244051. Epub 2012/01/17. eng.

2. Harisson LH, Trotter CL, Ramsay ME. Global epidemiology of meningococcal disease. Vaccine. 2009:275 B51-B63.

3. Ladhani S, Slack M, Heath P, Gottberg Av, Chandra M, Ramsay M. Invasive haemophilus influenzae disease, europe, 1996-2006. Emerg Infect Dis. 2010 Mar;16(3):455-63. PubMed PMID: 20202421. Epub 2010/03/06. eng.

4. Giufre M, Cardines R, Caporali MG, Accogli M, D'Ancona F, Cerquetti M. Ten years of hib vaccination in italy: Prevalence of non-encapsulated haemophilus influenzae among invasive isolates and the possible impact on antibiotic resistance. Vaccine. 2011 May 17;29(22):3857-62. PubMed PMID: 21459175. Epub 2011/04/05. eng.

5. Zanella RC BS, Andrade AL, Flannery B, Brandileone MC. Changes in serotype distribution of haemophilus influenzae meningitis isolates identified through laboratory-based surveillance following routine childhood vaccination against h. Influenzae type b in brazil. Vaccine 2011 Nov 2011;8;29(48):8937-42. doi: 10.1016/j.vaccine.2011.09.053. Epub 2011 Sep 22.

6. Agrawal A, Murphy TF. Haemophilus influenzae infections in the h. Influenzae type b conjugate vaccine era. J Clin Microbiol. 2011 Nov;49(11):3728-32. PubMed PMID: 21900515. Pubmed Central PMCID: 3209133. Epub 2011/09/09. eng.

7. van Wessel K RG, Veenhoven RH, Spanjaard L, van der Ende A, Sanders EA. Nontypeable haemophilus influenzae invasive disease in the netherlands: A retrospective surveillance study 2001-2008. Clin Infect Dis 2011 Jul 1;53(1):e1-7 doi: 101093/cid/cir268. 2011;53(1):e1-7. doi: 10.1093/cid/cir268.

8. Lâm TT CH, Elias J, Hellenbrand W, Imöhl M, Prelog M, Sing A, van der Linden M, Vogel U. [infections with pneumococci, menigococci, h. Influenzae and diphtheria in germany: The rki reference network for invasive bacterial infections (ibi) at the 5th würzburg workshop on epidemiology, prevention and therapy for invasive meningococcal diseases 2010 (meeting report)]. Lâm TT, Claus H, Elias J, Hellenbrand W, Imöhl M, Prelog M, Sing A, van der Linden M, Vogel U. 2012;2012 Nov;74(11):747-53. doi: 10.1055/s-0031-1286269. Epub 2011 Dec 27.

9. MacNeil JR CA, Farley M, Mair R, Baumbach J, Bennett N, Gershman K, Harrison LH, Lynfield R, Petit S, Reingold A, Schaffner W, Thomas A, Coronado F, Zell ER, Mayer LW, Clark TA, Messonnier NE. Current epidemiology and trends in invasive haemophilus influenzae disease--united states, 1989-2008.Clin Infect Dis 2011 Dec;53(12):1230-6

10. Collins S RM, Campbell H, Slack MP, Ladhani SN. Invasive haemophilus influenzae type b disease in england and wales: Who is at risk after 2 decades of routine childhood vaccination? Clin Infect Dis 2013 Oct 10]. 2013.

11. Gkentzi D SM, Ladhani SN. The burden of nonencapsulated haemophilus influenzae in children and potential for prevention. Curr Opin Infect Dis 2012 J. 2012;un;25(3):266-72. doi: 10.1097/QCO.0b013e32835310a4.

12. Khatami A, Pollard AJ. The epidemiology of meningococcal disease and the impact of vaccines. Expert Rev Vaccines. 2010 Mar;9(3):285-98. PubMed PMID: 20218857. Epub 2010/03/12. eng.

13. Vogel U. Molecular epidemiology of meningococci: Application of DNA sequence typing. Int J Med Microbiol. 2010 Nov;300(7):415-20. PubMed PMID: 20537945. Epub 2010/06/12. eng.

14. Campbell H, Andrews N, Borrow R, Trotter C, Miller E. Updated postlicensure surveillance of the meningococcal c conjugate vaccine in england and wales: Effectiveness, validation of serological correlates of protection, and modeling predictions of the duration of herd immunity. Clin Vaccine Immunol. 2010 March 10;17(5): 840–847. .

15. Trotter CL, Andrews NJ, Kaczmarski EB, Miller E, Ramsay ME. Effectiveness of meningococcal serogroup c conjugate vaccine 4 years after introduction. Lancet. 2004 24-30 Jul 2004 364(9431):365-7.

16. Trotter CL, Ramsay ME. Vaccination against meningococcal disease in europe: Review and recommendations for the use of conjugate vaccines. FEMS Microbiology Reviews. 2006 31 Jan 2007;31(1):101-7. Epub 1 Dec 2006.

17. J. Leimkugel1 VR, L. Jacintho da Silva2 and G. Pluschke1. Global review of meningococcal disease. A shifting etiology. Journal of Bacteriology Research Vol1(1) , pp 006–018 , April 2009

18. Hershey JH HW. Epidemiology and meningococcal serogroup distribution in the united states. Clin Pediatr (Phila) 2010 2010;Jun;49(6):519-24. doi: 10.1177/0009922809347797.

19. M. Toropainen AV, L. Saarinen, H. Käyhty, M. Kuusi, A. Virolainen* (Helsinki, FI), Increase of invasive meningococcal disease caused by serogroup y in finland, 2010. 21st European Congress of Clinical Microbiology and Infectious Diseases (ECCMID)27th International Congress of Chemotherapy (ICC). 2010.

20. LH. H. Epidemiological profile of meningococcal disease in the united states. Clin Infect Dis 2010 Mar 1;50 Suppl 2:S37-44 doi: 101086/648963. 2010;50 Suppl 2:S37-44. doi: 10.1086/648963.

21. Jolley KA, Kalmusova J, Feil EJ, Gupta S, Musilek M, Kriz P, et al. Carried meningococci in the czech republic: A diverse recombining population. Journal of Clinical Microbiology. 2000 Dec 2008;38(12):4492-8.

22. Trotter CL, Chandra M, Cano R, Larrauri A, Ramsay ME, Brehony C, et al. A surveillance network for meningococcal disease in europe. FEMS Microbiol Rev. 2006 31 Jan 2007;31(1):27-36. Epub 2006 Dec 1.

23. Jounio U SA, Bratcher HB, Bloigu A, Juvonen R, Silvennoinen-Kassinen S, Peitso A, Harju T, Vainio O, Kuusi M, Maiden MC, Leinonen M, Käyhty H, Toropainen M. Genotypic and phenotypic characterization of carriage and invasive disease isolates of neisseria meningitidis in finland. J Clin Microbiol. 2012 Feb;50(2):264-73. doi: 10.1128/JCM.05385-11. Epub 2011 Nov 30.

24. Ladhani SN FJ, Ramsay ME, Campbell H, Gray SJ, Kaczmarski EB, Mallard RH, Guiver M, Newbold LS, Borrow R. Invasive meningococcal disease in england and wales: Implications for the introduction of new vaccines. Vaccine 2012 May 21;30(24):3710-6 doi: 101016/jvaccine201203011 Epub 2012 Mar 17. 2012;30(24):3710-6. doi: 10.1016/j.vaccine.2012.03.011. Epub 2012 Mar 17.

25. Baccarini C TA, Wieffer H, Vyse A. The changing epidemiology of meningococcal disease in north america 1945-2010. Hum Vaccin Immunother 2013 Jan;9(1):162-71 doi: 104161/hv22302 Epub 2012 Oct 29. 2013;9(1):162-71. doi: 10.4161/hv.22302. Epub 2012 Oct 29.

26. Gossger N, Snape MD, Yu LM, Finn A, Bona G, Esposito S, et al. Immunogenicity and tolerability of recombinant serogroup b meningococcal vaccine administered with or without routine infant vaccinations according to different immunization schedules: A randomized controlled trial. JAMA. 2012 Feb 8;307(6):573-82. PubMed PMID: 22318278. Epub 2012/02/10. eng.

Annex 1: Invasive *H. influenzae* disease

Methods

Table A1. Invasive *H. influenzae* disease EU case definitions, 2002 and 2008

EU case definition confirmed 2002 (Decision 2002/253/EC)	EU case definition confirmed 2008 (EC Decision of 28/IV/2008)
Confirmed case A clinically compatible case diagnosed by one of the following laboratory criteria: • Isolation of *H. influenzae* from a normally sterile site • Detection *of H. influenzae* nucleic acid from a normally sterile site *Probable case* A clinically compatible case diagnosed by the following laboratory criteria: • Detection of *H influenzae* antigen from normally sterile site. *Possible case* A case with clinical epiglottitis without any laboratory confirmation or with identification only from non-sterile site	*Clinical Criteria* Not relevant for surveillance purposes *Laboratory Criteria* Laboratory criteria for case definition At least one of the following two: • Isolation of *H. influenzae* from a normally sterile site • Detection of *H. influenzae* nucleic acid from a normally sterile site Typing of the isolates should be performed, if possible *Epidemiological link: NA* *Case Classification* • Possible case: NA • Probable case: NA • Confirmed case: Any person meeting the laboratory criteria for case confirmation

Data source table

Table A1. Overview of the sources of data used for *H. influenzae* disease report, 2010

Country	Data source*	Compulsory(Cp)/Voluntary (V)	Comprehensive(Co)/Sentinel (Se)	Active(A) / Passive(P)	Case-based(CB)/Aggregated(A)	Data reported by			
						Laboratories	Physicians	Hospitals	Others
Austria	AT-Epidemiegesetz	Cp	Co	P	C	Y	Y	Y	Y
Belgium	BE-LABNET	V	Se	A	C	Y	N	U	U
Bulgaria	BG-NATIONAL_SURVEILLANCE	Cp	Co	P	A	Y	Y	Y	Y
Cyprus	CY-NOTIFIED_DISEASES	Cp	Co	P	C	N	Y	N	N
Czech Republic	CZ-EPIDAT	Cp	Co	A	C	Y	Y	Y	N
Denmark	DK-MIS	Cp	Co	P	C	N	Y	N	N
Estonia	EE-HIB	Cp	Co	P	C	Y	Y	Y	Y
Finland	FI-NIDR	Cp	Co	P	C	Y	N	N	N
France	FR-EPIBAC	V	Se	A	C	Y	N	Y	N
Germany	DE-SURVNET@RKI-7.1	Cp	Co	P	C	Y	N	N	Y
Greece	GR-NOTIFIABLE_DISEASES	Cp	Co	P	C	Y	Y	Y	N
Hungary	HU-EFRIR	Cp	Co	P	C	Y	Y	Y	N
Iceland	IS-SUBJECT_TO_REGISTRATION	Cp	Co	P	C	Y	Y	Y	N
Ireland	IE-CIDR	Cp	Co	P	C	Y	Y	Y	N
Italy	IT-MENINGITIS	Cp	Co	P	C	N	Y	Y	Y
Latvia	LV-BSN	Cp	Co	P	C	Y	Y	Y	N
Liechtenstein	-	-	-	-	-	-	-	-	-
Lithuania	LT-COMMUNICABLE_DISEASES	Cp	Co	P	C	Y	Y	N	N
Luxembourg	LU-SYSTEM1	Cp	Co	P	C	U	Y	N	N
Malta	MT-DISEASE_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	Y
Netherlands	NL-OSIRIS	Cp	Co	P	C	Y	Y	N	N
Norway	NO-MSIS_A	Cp	Co	P	C	Y	Y	Y	N
Poland	PL-NATIONAL_SURVEILLANCE	Cp	Co	P	C	Y	Y	N	N
Portugal	PT-HAEMOPHILUS_INFLUENZAE	Cp	Co	P	C	N	Y	N	N
Romania	RO-RNSSy	Cp	Co	P	C	N	N	Y	N
Slovakia	SK-EPIS	Cp	Co	A	C	Y	Y	Y	N
Slovenia	SI-SURVIVAL	Cp	Co	P	C	Y	Y	Y	N
Spain	ES-MICROBIOLOGICAL	V	Se	P	C	Y	N	N	N
Sweden	SE-SMINET	Cp	Co	P	C	Y	Y	N	N
United Kingdom	UK-HIB	O	Co	P	C	Y	N	Y	Y

Note: The clinically reported and laboratory reported cases are linked at national level.
**Sources of data used in the report.*
Cp= Comprehensive, Se=Sentinel, V=Voluntary, O=Other, Y=Yes, N=No.

Table A2. Completeness of reporting of invasive *H. influenzae* disease surveillance data, EU/EEA countries, 2010

Variable	Data completeness (%)	Min (%)	Max (%)	Number of reporting countries
Age(months)	98.6	80.7	100	25
Age (years)	99.6	66.7	100	25
Gender	99.7	98.9	100	25
Case classification	99.9	92.9	100	25
Clinical presentation	50.8	0	100	22
Date of onset	56.4	0	100	21
Date of diagnosis	54.0	0	100	19
Date of notification	26.7	0	100	19
Laboratory result	93.2	0	100	24
Outcome	55.1	0	100	22
Pathogen	100	100	100	25
Serotype	42.8	0	100	19
Specimen 1	92.5	0	100	22
Specimen 2	6.7	0	100	12
Test method 1	85.6	0	100	20
Test method 2	4.2	0	100	9
Vaccination status	11.4	0	100	19

Note: ECDC does not yet have a comprehensive overview of which variables are collected in the countries, therefore, missing data as well as variables reported as not applicable or unknown have been classified as incomplete reporting.
N= Number of countries reporting the variable.
Due to aggregated reporting, Bulgaria is not included in the table.

Results *H. influenzae* 2010

Table A3. Number and proportion (%) of all reported test methods used among cases of invasive *H. influenzae* disease by country, 2010

COUNTRY	CULT		ANTIGEN		GENOSEQ		MICRO		NUCLACID		Other		UNK		NA		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Austria	2	50	0	0	0	0	0	0	2	50	0	0	0	0	0	0	4
Czech Republic	21	95	0	0	0	0	0	0	0	0	0	0	1	5	0	0	22
Denmark	43	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43
Estonia	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Finland	76	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76
France	369	99	0	0	0	0	0	0	2	1	0	0	0	0	0	0	371
Germany	219	94	0	0	0	0	0	0	10	4	1	0	0	0	2	1	232
Greece	3	60	0	0	0	0	0	0	2	40	0	0	0	0	0	0	5
Hungary	6	55	2	18	0	0	0	0	0	0	0	0	0	0	3	27	11
Ireland	24	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
Italy	69	85	3	4	0	0	0	0	0	0	9	11	0	0	0	0	81
Malta	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	46	100	0	-	46
Poland	25	49	1	2	0	0	0	0	17	33	0	0	0	0	8	16	51
Romania	15	79	1	5	0	0	0	0	0	0	3	16	0	0	0	0	19
Slovakia	3	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Slovenia	15	50	0	0	0	0	0	0	15	50	0	0	0	0	0	0	30
Spain	77	99	0	0	0	0	0	0	1	1	0	0	0	0	0	0	78
Sweden	157	72	20	9	0	0	0	0	21	10	0	0	21	10	0	0	219
United Kingdom	548	80	0	0	0	0	0	0	0	0	0	0	74	11	61	9	683
EU	1 675	84	27	1	0	0	0	0	70	3	13	1	142	7	74	4	2 001
Norway	91	99	0	0	0	0	0	0	1	1	0	0	0	0	0	0	92
EU/EEA	1 766	84	27	1	0	0	0	0	71	3	13	1	142	7	74	4	2 093

Note: Records where both the specimen and all the test methods belonging to that specimen were UNK/Missing/NA were excluded from these calculations.

Table A4. Number and notification rates (per 100 000 population) of confirmed and probable cases of invasive *H. influenzae* disease by country, EU/EEA*, 2010

Country	Total		Confirmed		Probable		Possible		Population
	Number of cases	Notification rate	Number of cases	Notification rate	Number of cases	Notification rate	Number of cases	Notification rate	
Austria	2	0.02	2	0.02	-		-		8 375 290
Bulgaria	10	0.13	10	0.13	-		-		7 563 710
Cyprus	3	0.37	3	0.37	-		-		803 147
Czech Republic	22	0.21	22	0.21	-		-		10 506 813
Denmark	43	0.78	43	0.78	-		-		5 534 738
Estonia	1	0.07	1	0.07	-		-		1 339 993
Finland	40	0.75	40	0.75	-		-		5 351 427
France	371	0.8	371	0.8	-		-		47 556 212
Germany	224	0.27	224	0.27	-		-		81 802 256
Greece	4	0.04	4	0.04	-		-		11 305 118
Hungary	5	0.05	5	0.05	-		-		10 014 324
Ireland	28	0.63	26	0.58	-		2	0.04	4 467 854
Italy	69	0.11	69	0.11	-		-		60 340 328
Lithuania	2	0.06	1	0.03	1	0.03	-		3 329 039
Malta	2	0.48	2	0.48	-		-		412 970
Netherlands	43	0.26	43	0.26	-		-		16 574 989
Poland	25	0.07	25	0.07	-		-		38 167 328
Portugal	10	0.09	10	0.09	-		-		10 637 713
Romania	19	0.09	19	0.09	-		-		21 462 186
Slovakia	3	0.06	3	0.06	-		-		5 424 925
Slovenia	15	0.73	15	0.73	-		-		2 046 976
Norway	89	1.83	89	1.83	-		-		4 858 199
Sweden	179	1.92	179	1.92	-		-		9 340 682
United Kingdom	622	1	622	1	-		-		62 008 048
EU/EEA	1 831	0.43	1 828	0.43	1	0	2	0	42 922 4265

**France, Belgium, Spain data collected by sentinel surveillance. Belgium and Spain no population data provided.*

Table A5. Number and notification rates* (per 100 000 population) of invasive *H. influenzae* disease by gender, EU/EEA countries, 2010

Country	Male		Female		Ratio	Population	Population
	n	NR	n	NR	Male to Female	Female	Male
Austria	2	0.05	-	0		42 961 97	4 079 093
Bulgaria	7	0.19	3	0.08	2.49	3 904 399	3 659 311
Cyprus	3	0.75	-	0		405 095	398 052
Czech Republic	9	0.17	13	0.24	0.72	5 349 616	5 157 197
Denmark	25	0.91	18	0.64	1.41	2 791 452	2 743 286
Estonia	-	0	1	0.14	0	722 730	617 263
Finland	15	0.57	25	0.92	0.62	2 726 360	2 625 067
Germany	116	0.29	108	0.26	1.12	41 698 652	40 103 608
Greece	1	0.02	3	0.05	0.34	5 707 653	5 597 465
Hungary	2	0.04	3	0.06	0.74	5 257 424	4 756 900
Ireland	16	0.72	10	0.44	1.63	2 251 410	2 216 444
Italy	35	0.12	34	0.11	1.09	31 052 924	29 287 404
Lithuania	1	0.06	-	0		1 781 288	1 547 751
Malta	2	0.97	-	0		207 551	205 419
Netherlands	22	0.27	21	0.25	1.07	8 371 513	8 203 476
Poland	18	0.1	7	0.04	2.75	19 738 588	18 428 742
Portugal	7	0.14	3	0.05	2.49	5 489 510	5 148 203
Romania	10	0.1	9	0.08	1.17	11 011 093	10 451 093
Slovakia	-	0	3	0.11	0	2 787 987	2 636 938
Slovenia	10	0.99	5	0.48	2.04	1 032 869	1 014 107
Sweden	86	1.85	93	1.98	0.93	4 691 668	4 649 014
United Kingdom	304	1	312	0.99	1.01	31 516 708	30 491 340
EU	691	0.38	671	0.35	1.08	192 792 688	184 017 168
Norway	34	1.4	54	2.22	0.63	2 431 447	2 426 752
EU/EEA	725	0.39	725	0.37	1.05	195 224 128	186 443 920

** Belgium, France and Spain reported data from sentinel surveillance.*

Table A6. Total number and notification rates (per 100 000 population) of invasive *H. influenzae* disease by country* and age group, 2010

Country	Age group									
	<0		1-4		5-14		15-64		>65	
	Number of cases	Notification rate	Number of cases	Notification rate	Number of cases	Notification rate	Number of cases	Notification rate	Number of cases	Notification rate
Austria	0	0	1	0.32	1	0.12	0	0	0	0
Cyprus	0	0	0	0	0	0	1	0.18	1	0.95
Czech Republic	0	0	0	0	1	0.11	14	0.19	7	0.44
Denmark	0	0	2	0.76	0	0	19	0.52	22	2.44
Estonia	0	0	0	0	0	0	0	0	1	0.44
Finland	1	1.65	1	0.42	1	0.17	18	0.51	19	2.09
Germany	6	0.9	10	0.36	5	0.07	55	0.1	148	0.88
Greece	0	0	1	0.22	1	0.09	0	0	1	0.05
Hungary	1	1.05	0	0	1	0.1	1	0.01	2	0.12
Ireland	1	1.36	2	0.72	2	0.33	9	0.3	11	2.17
Italy	6	1.07	3	0.13	1	0.02	31	0.08	28	0.23
Lithuania	1	2.74	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	1	0.35	1	1.64
Netherlands	5	2.71	8	1.08	4	0.2	10	0.09	16	0.63
Poland	10	2.4	3	0.2	3	0.08	8	0.03	1	0.02
Portugal	0	0	0	0	1	0.09	3	0.04	6	0.32
Romania	7	3.17	9	1.04	1	0.05	1	0.01	1	0.03
Slovakia	1	1.64	0	0	0	0	2	0.05	0	0
Slovenia	2	9.18	0	0	2	1.08	3	0.21	8	2.37
Sweden	6	5.35	5	1.15	1	0.1	60	0.98	107	6.33
United Kingdom	53	6.8	34	1.12	16	0.23	228	0.56	290	2.85
EU	100	2.64	79	0.53	41	0.11	464	0.19	670	1.03
Norway	2	3.22	4	1.65	2	0.33	34	1.06	47	6.5
EU/EEA	102	2.65	83	0.55	43	0.11	498	0.2	717	1.09

**Belgium. France and Spain reported data from sentinel surveillance. Bulgaria reported aggregated data*

Result communicated by France: <0: 5.1(25); 1-4:8.00 (17); 5-14:0.19 (9); 15-64:0,53 (153) >65:2.80 (185)

Table A7. Percentage distribution of invasive *H. influenzae* disease by serotype, EU/EEA countries, 2010

Country	Serotype b		Serotype non-b		Serotype non-caps		Serotype unknown	
	number	%	number	%	number	%	number	%
Austria	2	100.0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	68	100.0
Cyprus	0	0	0	0	0	0	3	100.0
Czech Republic	2	9.1	2	9.1	11	50.0	7	31.8
Denmark	3	7.0	6	14.0	34	79.1	0	0
Estonia	1	100.0	0	0	0	0	0	0
Finland	3	7.5	3	7.5	6	15.0	28	70.0
France	4	1.1	10	2.7	47	12.7	310	83.6
Germany	0	0	0	0	0	0	224	100.0
Greece	2	50.0	2	50.0	0	0	0	0
Hungary	0	0	2	40.0	0	0	3	60.0
Ireland	3	11.5	3	11.5	20	76.9	0	0
Italy	3	4.3	5	7.2	25	36.2	36	52.2
Lithuania	0	0	0	0	0	0	1	100.0
Malta	0	0	0	0	0	0	2	100.0
Netherlands	43	100.0	0	0	0	0	0	0
Poland	10	40.0	0	0	8	32.0	7	28.0
Portugal	0	0	0	0	0	0	10	100.0
Romania	3	15.8	0	0	0	0	16	84.2
Slovakia	1	33.3	0	0	0	0	2	66.7
Slovenia	0	0	1	6.7	14	93.3	0	0
Spain	2	2.6	1	1.3	21	26.9	54	69.2
Sweden	13	7.3	13	7.3	36	20.1	117	65.4
United Kingdom	40	6.4	74	11.9	315	50.6	193	31.0
EU Total	135	7.0	122	6.3	537	27.7	1148	59.1
Norway	2	2.2	18	20.2	56	62.9	13	14.6
EU/EEAl	137	6.7	140	6.9	593	29.2	1161	57.2

Table A8. Number of cases and notification rate per (100 000) of reported invasive *H. influenzae* serotypes b cases <5 years, by country, 2010

Country	Cases (n) by age (years)						Notification rate (100 000)	Notification rate (100 000)
	<0 y	1 y	2 y	3 y	4 y	0-4 y	<0 y	0-4 y
Austria	0	0	0	0	1	1	0	0.25
France	1	1	1	0	0	3	-	-
Italy	1	0	0	0	0	1	0.18	0.04
Netherlands	5	4	2	2	0	13	2.71	1.41
Poland	4	3	0	0	0	7	0.96	0.36
Romania	0	0	1	0	2	3	0	0.28
Sweden	4	1	0	0	0	5	3.57	0.91
Slovakia	1	0	0	0	0	1	1.64	0.36
United Kingdom	6	0	1	1	0	8	0.77	0.21
Total	22	9	5	3	3	42	0.91	0.35

Table A9. Percentage distribution of invasive *H. influenzae* disease cases by clinical presentation and country, EU/EEA, 2010

	Meningitis		Septicaemia		Meningitis& septicaemia		Pneumonia		Osteomyelitis		Cellulitis		Epiglottitis		Other		Total
Country	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Austria	1	50	0	0	1	50	0	0	0	0	0	0	0	0	0	0	2
Czech Republic	4	18.18	12	54.55	2	9.09	3	13.64	1	4.55	0	0	0	0	0	0	22
Denmark	5	11.63	38	88.37	0	0	0	0	0	0	0	0	0	0	0	0	43
Estonia	0	0	1	100	0	0	0	0	0	0	0	0	0	0	0	0	1
Finland	0	0	40	100	0	0	0	0	0	0	0	0	0	0	0	0	40
France	18	28.57	32	50.79	0	0	9	14.29	0	0	0	0	1	1.59	3	4.76	63
Germany	17	8.02	40	18.87	3	1.42	72	33.96	2	0.94	0	0	0	0	78	36.79	212
Greece	4	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Hungary	5	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Ireland	1	6.67	8	53.33	1	6.67	5	33.33	0	0	0	0	0	0	0	0	15
Italy	23	33.33	32	46.38	2	2.9	10	14.49	0	0	0	0	0	0	2	2.9	69
Lithuania	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100	1
Netherlands	12	30	9	22.5	0	0	11	27.5	1	2.5	1	2.5	1	2.5	5	12.5	40
Norway	1	1.54	25	38.46	4	6.15	26	40	1	1.54	0	0	0	0	8	12.31	65
Poland	8	32	13	52	3	12	0	0	0	0	0	0	0	0	1	4	25
Portugal	2	22.22	0	0	0	0	7	77.78	0	0	0	0	0	0	0	0	9
Romania	16	84.21	0	0	0	0	0	0	0	0	0	0	0	0	3	15.79	19
Slovakia	1	33.33	0	0	0	0	0	0	0	0	0	0	0	0	2	66.67	3
Slovenia	2	28.57	3	42.86	0	0	2	28.57	0	0	0	0	0	0	0	0	7
Spain	7	8.97	68	87.18	0	0	0	0	1	1.28	0	0	0	0	2	2.56	78
United Kingdom	24	7.82	263	85.67	0	0	12	3.91	0	0	1	0.33	1	0.33	6	1.95	307
EU/EEA Total	152	14.74	584	56.64	16	1.55	157	15.23	6	0.58	2	0.19	3	0.29	111	10.77	1 031

Table A10. Clinical presentation of invasive *H. influenzae* disease by serotype and age group, EU/EEA, 2010

Serotype b											
Clinical presentation	Age in years										
	<1	%	1-4	%	5-14	%	15-64	%	65+	%	Total
Meningitis	8	27.6	13	44.8	1	3.4	6	20.7	1	3.4	29
Septicaemia	5	12.8	2	5.1	2	5.1	15	38.5	15	38.5	39
Meningitis & septicaemia	2	40.0	0	0.0	1	20.0	2	40.0	0	0.0	5
Pneumonia	0	0.0	1	7.1	2	14.3	3	21.4	8	57.1	14
Osteomyelitis	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0	1
Cellulitis	2	100.0	0	0.0	0	0.0	0	0.0	0	0.0	2
Epiglottitis	0	0.0	0	0.0	0	0.0	1	33.3	2	66.7	3
Other	0	0.0	1	14.3	2	28.6	2	28.6	2	28.6	7
Total	17	17.0	17	17.0	8	8.0	29	29.0	29	29.0	100
Serotype non-b											
Clinical presentation	Age in years										
	<1	%	1-4	%	5-14	%	15-64	%	65+	%	Total
Meningitis	6	54.5	2	18.2	0	0.0	0	0.0	3	27.3	11
Septicaemia	2	3.3	7	11.5	0	0.0	22	36.1	30	49.2	61
Meningitis & septicaemia	1	33.3	0	0.0	0	0.0	1	33.3	1	33.3	3
Pneumonia	0	0.0	1	8.3	0	0.0	7	58.3	4	33.3	12
Osteomyelitis	0	0.0	0	0.0	1	100.0	0	0.0	0	0.0	1
Cellulitis	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Epiglottitis	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Other	0	0.0	0	0.0	0	0.0	2	100.0	0	0.0	2
Total	9	10.0	10	11.1	1	1.1	32	35.6	38	42.2	90
Serotype non-capsulated											
Clinical presentation	Age in years										
	<1	%	1-4	%	5-14	%	15-64	%	65+	%	Total
Meningitis	3	6.3	8	16.7	4	8.3	16	33.3	17	35.4	48
Septicaemia	34	11.0	15	4.9	8	2.6	107	34.7	144	46.8	308
Meningitis & septicaemia	0	0.0	1	25.0	0	0.0	2	50.0	1	25.0	4
Pneumonia	2	6.5	0	0.0	0	0.0	12	38.7	17	54.8	31
Osteomyelitis	0	0.0	0	0.0	0	0.0	1	100.0	0	0.0	1
Cellulitis	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Epiglottitis	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Other	0	0.0	1	12.5	1	12.5	3	37.5	3	37.5	8
Total	39	9.8	25	6.3	13	3.3	141	35.3	182	45.5	400

Table A11. Case–fatality ratio and total number of confirmed invasive *H. influenzae* cases, by country, 2010

Country	Number of deaths	Number of cases	Case fatality rate (%)
Austria	0	2	0
Belgium	0	68	0
Cyprus	0	3	0
Czech Republic	2	22	9
Denmark	0	43	0
Estonia	0	1	0
France	0	371	0
Germany	14	224	6
Greece	0	4	0
Hungary	0	5	0
Ireland	0	26	0
Italy	5	69	7
Lithuania	0	1	0
Malta	0	2	0
Netherlands	4	43	9
Poland	3	25	12
Portugal	0	10	0
Romania	1	19	5
Slovakia	0	3	0
Slovenia	0	15	0
Spain	0	78	0
Sweden	13	179	7
United Kingdom	42	622	7
EU	84	1 902	4
Norway	13	89	15
EU/EEA	97	1 991	5

Note: Outcome data are not collected in Spain.

Table A12. Case–fatality ratio of invasive *H. influenzae* cases, by serotype, EU/EEA countries, 2010

Serotype	Number of deaths	Number of cases	Case–fatality ratio
b	7	134	5.2
non-b	11	137	8.0
non-caps	42	587	7.1

Table A13. Case–fatality ratio of invasive *H. influenzae* by clinical presentation, EU/EEA countries, 2010

Clinical presentation	Number of deaths	Number of cases	Case–fatality ratio (%)
Cellulitis	0	2	0
Epiglottitis	0	3	0
Meningitis	3	152	2
Meningitis and septicemia	2	16	12.3
Osteomyelitits	0	6	0
Pneumonia	15	157	9.56
Septicemia	45	544	8.27
Others	4	111	3.6

Table A14. Total numbers of invasive *H. influenzae* serotype b by disease with reported vaccination status, by country, 2010

	Fully vaccinated		Partly vaccinated		Not vaccinated		Unknown		Total
Country	n	%	n	%	n	%	n	%	
Austria	1	50	0	0	1	50	0	0	2
Czech Republic	0	0	0	0	1	50	1	50	2
Denmark	0	0	0	0	0	0	3	100	3
Estonia	0	0	0	0	1	100	0	0	1
Finland	0	0	0	0	0	0	3	100	3
France	3	75	0	0	1	25	0	0	4
Greece	0	0	0	0	2	100	0	0	2
Ireland	1	33	0	0	2	67	0	0	3
Italy	0	0	1	33	1	33	1	33	3
Netherlands	11	26	1	2	23	53	8	19	43
Norway	0	0	0	0	1	50	1	50	2
Poland	0	0	2	20	8	80	0	0	10
Romania	0	0	0	0	0	0	3	100	3
Slovakia	0	0	1	100	0	0	0	0	1
Spain	0	0	0	0	0	0	2	100	2
Sweden	1	8	2	15	3	23	7	54	13
United Kingdom	3	8	0	0	2	5	35	88	40
EU/EEA Total	20	15	7	5	46	34	64	47	137

Inclusion criteria: Countries reporting ≥1case(s) of serotype b in 2009.

Table A15. Year of introduction of conjugate *H. influenzae* serotype b vaccination and childhood immunisation schedule in 2010

Country	Year of Hib introduction	Vaccine given	Combined with	Immunisation schedule	Source date
Austria	1994	Hib-PRP-T	DTaP, IPV, HBV	2, 4, 6 months, AND 2nd year of life	Jan-08
Belgium	1993	Hib-PRP-T	DTaP, IPV, HBV	8, 12, 16 weeks AND 15 months	Aug-08
Bulgaria	2010	Hib-PRP-T	DTaP, IPV, Hib	2, 3, 4 months AND 16 months	Jan -10
Cyprus	2001	Hib-PRP-T	not combined	2–3, 4–5, 6–8, AND 12–18 months	Mar-09
Czech Republic	2001	Hib-PRP-T	DTaP, IPV, HBV	3, 4, 5 month AND 11–18 months	Nov-10
Denmark	1993	Hib-PRP-T	DTaP, IPV	3, 5, AND 12 months	Mar-09
Estonia	2005	Hib-PRP-T	DTaP, IPV	3, 4.5, 6 months AND 2 years	Febr-11
Finland	1986	Hib-PRP-T	DTaP, IPV	3, 5, AND 12 months	Sep-09
France	1992	Hib-PRP-T	DTaP, IPV, HBV	2, 3, 4, AND 16–18 months	Mar-09
Germany	1990	Hib-PRP-T	DTaP, IPV, HBV	2, 3, 4 months AND 11–14 months	Jul-09
Greece	1999	Hib-PRP-T	DTaP, IPV/OPV, HBV	2, 4, 6, AND 12–15 months	Apr-07
Hungary	1999	Hib-PRP-T	DTaP, IPV	2, 3, 4, AND 18 months	Jan-10
Iceland	1989	Hib-PRP-T	DTaP, IPV	3, 5, AND 12 months	Oct-07
Ireland	1992	Hib-PRP-T	DTaP, IPV, HBV	2, 4, 6, AND 13 months	Jan-09
Italy	1995 (1999 included in routine schedule)	Hib PRP-T	DTaP, IPV, HBV	3, 5, AND 11 months	Oct-10
Latvia	1994	Hib-PRP-T	DTaP, IPV, HBV	2, 4, 6 AND 12–15 months	Apr-10
Lichtenstein	-	-	-	-	
Lithuania	2004	Hib-PRP-T	DTaP, IPV	2, 4, 6 AND 18 months	Jan-08
Luxembourg	1992	Hib-PRP-T	1st, 2nd and 4th dose: DTaP, IPV, HBV 3rd dose: DTaP, IPV	2, 3, 4 AND 12 months	Apr-08
Malta	1996	Hib-PRP-T	Public: DTwP-OPV Private: DTaP-IPV-HBV	Public: 6–8 weeks, 3 AND 4 months Private: 2, 3, 4, AND 12–18 months	Mar-09
Netherlands	1993	Hib-PRP-T	DTaP, IPV	2, 3, 4, AND 11 months	Dec-06
Norway	1992	-	DTaP, IPV	3, 5, 12 months	Sep-06
Poland	2005	Hib		2, 3–4, 5–6, AND 16–18 months	Apr-07
Portugal	2000	Hib	1st, 2nd and 3rd dose: DTaP, IPV 4th dose: DTaP	2, 4, 6, AND 18 months	Mar-09
Romania	2010	Hib-PRP-T	DTaP-IPV-Hib	2, 4, 6 AND 12 months	Jan-10
Slovakia	2000	Hib	DTaP-IPV-HBV	2, 4 AND 10 months	Mar-09
Slovenia	2000	Hib-PRP-T	DTaP, IPV	3, 4–5, 6, AND 12–24 months	Apr-09
Spain	1998	Hib-PRP-T	DTaP, IPV, IPV	2, 4, 6, AND 15–18 months	Jun-08
Sweden	1993	Hib-PRP-T	DTaP, IPV	3, 5, AND 12 months	Apr-10
United Kingdom	1992	Hib-PRP-T	1st, 2nd and 3rd dose: DTaP, IPV 4th dose: MenC	2, 3, 4 AND 12 months	Apr-10

Source: EUVAC.NET (June 2010) http://www.euvac.net/graphics/euvac/vaccination/vaccination.html
Cyprus, Czech Republic and Estonia: comments from the countries.

Annex 2: Invasive meningococcal disease

Methods

Table B1. Invasive meningococcal disease EU case definitions, 2002 and 2008

EU case definition confirmed 2002 (Decision 2002/253/EC)	EU case definition confirmed 2008 (EC Decision of 28/IV/2008)
Confirmed case A clinically compatible case diagnosed by one or more of the following laboratory criteria: • Isolation of *N. meningitidis* from a normally sterile site • Detection of *N. meningitidis* nucleic acid from normally sterile site • Detection of *N. meningitidis* antigen from normally sterile site • Demonstration of Gram-negative diplococci from normally sterile site by microscopy *Probable case* A clinically compatible case that is diagnosed by one or more of the following laboratory criteria: • *N. meningitidis* identification from a non-sterile site • High levels of meningococcal antibody in convalescent serum or • Clinical picture compatible with meningococcal disease (e.g. meningitis and/or meningococcemia that may progress rapidly to *purpura fulminans*, shock and death. Other manifestations are possible) without any laboratory confirmation.	*Clinical criteria* Any person with at least one of the following five: • Fever • Meningeal signs • Petechial rash • Septic shock • Septic arthritis *Laboratory criteria* At least one of the following four: • Isolation of *N. meningitidis* from normally sterile site, including purpuric skin lesions • Detection of *N. meningitidis* nucleic acid from a normally sterile site, including purpuric skin lesions • Detection of *N. meningitidis* antigen in CSF • Detection of Gram-negative stained diplococci in CSF *Epidemiological criteria* • An epidemiological link by human-to-human transmission *Case classification* A. Possible case • Any person meeting the clinical criteria B. Probable case • Any person meeting the clinical criteria and with an epidemiological link C. Confirmed case • Any person meeting the laboratory criteria

Data source

Table B2. Overview of the sources of data used for invasive meningococcal disease report, 2010

Country	Data Source*	Legal character	Comprehensiveness	Active	Case-based	Data reported by			
						Laboratories	Physicians	Hospitals	Others
Austria	AT-Epidemiegesetz	Cp	Co	P	C	Y	Y	Y	Y
Belgium	BE FRENCHCOMMUNITY BE FLANDERS_BRUSSEL	Cp	Co	P	C	Y	Y	Y	Y
Bulgaria	BG-NATIONAL_SURVEILLANCE	Cp	Co	P	A	Y	Y	Y	Y
Cyprus	CY -NOTIFIED_DISEASES	Cp	Co	P	C	N	Y	N	N
Czech Republic	CZ-EPIDAT	Cp	Co	P	C	Y	Y	Y	N
Denmark	DK-MIS	Cp	Co	P	C	N	Y	N	N
Estonia	EE-MENINGOCOCC	Cp	Co	P	C	Y	Y	Y	Y
Finland	FI-NIDR	Cp	Co	P	C	Y	Y	N	N
France	FR-MANDATORY_INFECTIOUS_DISEASES	Cp	Co	P	C	Y	Y	Y	Y
Germany	DE-SURVNET@RKI-7.1/6	Cp	Co	P	C	Y	Y	Y	Y
Greece	GR-NOTIFIABLE_DISEASES	Cp	Co	P	C	Y	Y	Y	N
Hungary	HU-EFRIR	Cp	Co	P	C	Y	Y	Y	N
Iceland	IS-SUBJECT_TO_REGISTRATION	Cp	Co	P	C	Y	Y	Y	N
Ireland	IE-CIDR	Cp	Co	P	C	Y	Y	Y	N
Italy	IT-MENINGITIS	Cp	Co	P	C	N	Y	Y	N
Latvia	LV-BSN	Cp	Co	P	C	Y	Y	Y	N
Latvia	LV-LABORATORY	Cp	Co	P	C	Y	N	N	N
Lithuania	LT-COMMUNICABLE_DISEASES	Cp	Co	P	C	Y	Y	N	N
Luxembourg	LU-SYSTEM1	Cp	Co	P	C	-	Y	N	N
Malta	MT-DISEASE_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	Y
Netherlands	NL-AGGR	Cp	Co	P	A	Y	Y	N	Y
Netherlands	NL-OSIRIS	Cp	Co	P	C	Y	Y	N	Y
Norway	NO-MSIS_A	Cp	Co	P	C	Y	Y	Y	N
Poland	PL-NATIONAL_SURVEILLANCE	Cp	Co	P	C	Y	Y	N	N
Portugal	PT-MENINGOCOCAL	Cp	Co	P	C	Y	Y	N	N
Romania	RO-RNSSy	Cp	Co	P	C	N	N	Y	N
Slovakia	SK-EPIS	Cp	Co	P	C	Y	Y	Y	N
Slovenia	SI-SURVIVAL	Cp	Co	P	C	Y	Y	Y	N
Spain	ES STATUTORY_DISEASES	Cp	Co	P	C	N	Y	Y	N
Sweden	SE-SMINET	Cp	Co	P	C	Y	Y	N	N
United Kingdom	UK-MENINGOCOCCAL	O	Co	P	C	Y	N	Y	Y

**Sources of data used in the report.*
Cp: compulsory; Co: comprehensive; P: passive; C: case-based; A: active; Y: Yes; N: No.
Clinically and laboratory notified cases are linked at national level, and submitted to TESSY with a single identifier.

Data quality

Table B3. Summary of the completeness of invasive meningococcal disease surveillance data, EU/EEA countries, 2010 (n=4 016)

Variable	Frequency of reporting (%)	Min %	Max%	Reporting* countries (N=28)
Age month	98.9	92.7	100	28
Age	95.9	73.2	100	28
Classification	99.6	96	100	28
Clinical criteria	82.1	0	100	24
Clinical presentation	46.3	0	100	22
Date of diagnosis	43.8	0	100	20
Date of notification	51.6	0	100	24
Date of onset	74.1	0	100	25
Gender	99.5	96.9	100	28
Imported	45	0	100	21
Laboratory result	95	0	100	27
MIC-CIP	35.6	0	98.5	19
MIC-CTX	25	0	100	16
MIC-PEN	41.8	0	100	20
MIC-RIF	34.2	0	100	17
Outcome	87.5	0	100	26
Pathogen	100	100	100	28
Probable country of infection	0.5	0	4.4	8
Result FetVR	31.2	0	97.1	16
Result MLST	19.2	0	89.7	12
Result PorA1	42.5	0	97.4	19
Result PorA2	42.4	0	97.4	19
Serogroup	90.2	28.1	100	28
Specimen1	68.4	0	100	26
Test method1	76.5	0	100	22
Vaccination status	31.2	0	100	21
Report type	100	100	100	28

**N= Number of countries reporting case-based enhanced variables*
Due to aggregated reporting, Bulgaria is not included in the table
Missing, not applicable and UNK values have been classified as incomplete values.

Results

Table B4. Number and percentage distribution of laboratory test methods used to confirm a case of invasive meningococcal disease, by country, 2010

Country	Culture		Antigen detection		Genome sequencing		Microscopy		Nucleic acid detection		Other		Unknown		Not applicable		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Austria	60	47.2	3	2.4	1	0.8	1	0.8	60	47.2	0	0	1	0.8	1	0.8	127
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	1	100	0	0	1
Czech Republic	38	66.7	1	1.8	0	0	0	0	18	31.6	0	0	0	0	0	0	57
Denmark	64	88.9	0	0	0	0	0	0	8	11.1	0	0	0	0	0	0	72
Estonia	1	50	1	50	0	0	0	0	0	0	0	0	0	0	0	0	2
Finland	66	98.5	1	1.5	0	0	0	0	0	0	0	0	0	0	0	0	67
France	459	55.9	20	2.4	0	0	208	25.3	134	16.3	0	0	0	0	0	0	821
Germany	272	59.7	26	5.7	0	0	60	13.2	73	16.0	2	0.4	1	0.2	22	4.8	456
Greece	31	40.8	0	0	0	0	0		38	50	2	2.6	5	6.6	0	0	76
Hungary	34	30.4	18	16.1	28	25	23	20.5	9	8.0	0	0	0		0	0	112
Ireland	47	36.7	0	0	0	0	0		80	63.0	0	0	1	0.8	0	0	128
Italy	123	76.9	21	13.1	0	0	2	1.3	14	8.8	0	0	0		0	0	160
Latvia	0		0	0	0	0	0	0	0	0	0	0	5	100	0	0	5
Lithuania	0		0	0	0	0	0	0	0	0	0	0	34	100	0	0	34
Luxembourg	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Malta	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Netherlands	0		0	0	0	0	0	0	0	0	0	0	157	100	0	0	157
Poland	167	34.7	6	1.3	141	29.3	2	0.4	76	16.0	0	0	0		89	18.5	481
Romania	22	40.7	12	22.2	4	7.4	16	29.6	0	0	0	0	0		0	0	54
Slovakia	28	75.7	2	5.4	0	00	1	2.7	6	16.2	0	0	0		0	0	37
Slovenia	7	77.8	0	0	0	0	0	0	2	22.2	0	0	0		0	0	9
Spain	188	88.3	0	0	0	0	0	0	25	11.7	0	0	0		0	0	213
Sweden	60	71.4	10	12.0	0	0	0	0	14	16.7	0	0	0		0	0	84
United Kingdom	445	45.3	0	0	0	0	0	0	502	51.1	0	0	35	3.6	0	0	982
EU	2 115	51.1	121	2.9	174	4.2	313	7.6	1 059	25.6	4	0.1	240	5.8	112	2.7	4 138
Iceland	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Norway	35	72.9	0	0	0	0	0	0	4	8.3	0	0	0	0	9	18.8	48
EU/EEA	2 152	51.4	121	2.9	174	4.2	313	7.5	1 063	25.4	4	0.1	240	5.7	121	2.9	4 188

Note: Records where both the specimen and the test methods were UNK/Missing/NA were excluded from this calculation.

Table B5. Notification rate (per 100 000 population) and total number of reported invasive meningococcal disease cases by classification and by country, 2010

Country	Total number of cases (n)	Notification rate (100 000)	Number of confirmed cases (n)	Notification rate (100 000)	Number of probable cases (n)	Notification rate (100 000)	Number of cases reported as classification unknown, possible or not applicable (n)	Notification rate (100 000)	Population
Austria	85	1.01	85	1.01	-		-		8 375 290
Belgium	96	0.89	96	0.89	-		-		10 839 905
Bulgaria	16	0.21	8	0.11	8	0.11	-		7 563 710
Cyprus	1	0.12	1	0.12	-		-		803 147
Czech Republic	60	0.57	60	0.57	-		-		10 506 813
Denmark	67	1.21	66	1.19	-		1	0.02	5 534 738
Estonia	2	0.15	2	0.15	-		-		1 339 993
Finland	34	0.64	34	0.64	-		-		5 351 427
France	522	0.81	510	0.79	1	0	11	0.02	64 716 312
Germany	385	0.47	384	0.47	1	0	-		81 802 256
Greece	56	0.5	55	0.49	-		1	0.01	11 305 118
Hungary	37	0.37	37	0.37	-		-		10 014 324
Ireland	114	2.55	98	2.19	16	0.36	-		4 467 854
Italy	150	0.25	150	0.25	-		-		60 340 328
Latvia	8	0.36	5	0.22	3	0.13	-		2 248 374
Lithuania	50	1.5	48	1.44	-		2	0.06	3 329 039
Luxembourg	1	0.2	1	0.2	-		-		502 066
Malta	2	0.48	2	0.48	-		-		412 970
Netherlands	143	0.86	143	0.86	-		-		16 574 989
Poland	230	0.6	228	0.6	-		2	0.01	38 167 328
Portugal	90	0.85	79	0.74	11	0.1	-		10 637 713
Romania	64	0.3	52	0.24	12	0.06	-		21 462 186
Slovakia	38	0.7	37	0.68	1	0.02	-		5 424 925
Slovenia	9	0.44	9	0.44	-		-		2 046 976
Spain	404	0.88	404	0.88	-		-		45 989 016
Sweden	68	0.73	67	0.72	1	0.01	-		9 340 682
United Kingdom	1 046	1.69	1 008	1.63	38	0.06	-		62 008 048
EU	3 778	0.75	3 669	0.73	92	0.02	17	0	501 105 536
Iceland	2	0.63	2	0.63	-		-		317 630
Norway	39	0.8	39	0.8	-		-		4 858 199
EU/EEA	3 819	0.75	3 710	0.73	92	0.02	17	0	506 281 376

Table B6. Seasonal distribution of invasive meningococcal disease cases by country, EU/EEA, 2010

Country	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Austria	12	8	8	6	8	9	9	2	1	7	9	4
Belgium	9	12	14	9	4	4	3	4	9	14	6	8
Bulgaria	1	2	4	6	1	1	0	1	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	1	0	0
Czech Republic	9	6	5	3	10	2	7	4	2	4	3	5
Denmark	6	5	3	7	3	6	3	6	8	6	5	9
Estonia	0	0	0	0	1	1	0	0	0	0	0	0
Finland	4	2	-	3	1	3	2	5	6	2	3	3
France	60	49	61	30	43	46	42	30	28	53	36	44
Germany	34	46	30	25	29	20	14	20	15	41	25	27
Greece	7	5	8	5	4	0	1	3	3	5	8	7
Hungary	3	1	2	3	2	1	1	4	1	11	2	6
Ireland	18	13	20	9	5	10	3	6	6	6	10	8
Italy	14	21	20	13	11	9	9	6	7	16	9	15
Latvia	0	2	0	0	0	1	2	2	0	0	0	1
Lithuania	1	5	7	3	8	2	4	1	4	7	5	3
Malta	1	0	0	0	0	0	0	1	0	0	0	0
Netherlands	16	8	12	10	7	23	12	12	14	9	11	9
Poland	27	16	32	22	12	17	14	8	13	18	27	24
Portugal	14	11	9	5	9	6	6	4	8	5	7	6
Romania	8	4	7	12	4	6	4	4	8	1	3	3
Slovakia	3	2	1	7	2	4	3	2	2	6	5	1
Slovenia	0	1	0	0	0	2	2	1	0	2	0	1
Spain	60	41	29	42	47	20	31	22	22	25	29	34
Sweden	3	-	3	5	10	7	9	5	8	6	4	8
United Kingdom	118	78	102	67	84	84	59	42	72	73	103	153
EU	428	338	377	292	305	284	240	195	237	318	310	379
Iceland	0	0	1	1	0	0	0	0	0	0	0	0
Norway	3	1	5	3	10	4	3	1	5	0	0	4
EU/EEA	431	339	383	296	315	288	243	196	242	318	310	383

Table B7. Invasive meningococcal disease cases and notification rates (100 000) by gender and by country, 2010

Country	Males		Females		Ratio	Population	
	Number of cases	Notification rate (100 000)	Number of cases	Notification rate (100 000)	Males/Females	Female	Male
Austria	42	1.03	43	1	1.0	4 296 197	4 079 093
Belgium	47	0.9	46	0.8	1.1	5 527 684	5 312 221
Cyprus	0	0	1	0.3	0	405 095	398 052
Czech Republic	36	0.7	24	0.5	1.6	5 349 616	5 157 197
Denmark	38	1.4	29	1.0	1.3	2 791 452	2 743 286
Estonia	2	0.3	0	0	0	722 730	617 263
Finland	22	0.8	12	0.4	1.9	2 726 360	2 625 067
France	289	0.9	233	0.7	1.3	33 384 930	31 331 380
Germany	193	0.5	191	0.5	1.1	41 698 652	40 103 608
Greece	35	0.6	21	0.4	1.7	5 707 653	5 597 465
Hungary	19	0.4	18	0.3	1.2	5 257 424	4 756 900
Ireland	68	3.1	46	2.0	1.5	2 251 410	2 216 444
Italy	76	0.3	74	0.2	1.1	31 052 924	29 287 404
Latvia	5	0.5	3	0.3	2.0	1 210 923	1 037 451
Lithuania	23	1.5	27	1.5	1.0	1 781 288	1 547 751
Luxembourg	1	0.4	0	0	0	252 660	249 406
Malta	1	0.5	1	0.5	1.0	207 551	205 419
Netherlands	75	0.9	68	0.8	1.1	8 371 513	8 203 476
Poland	120	0.7	110	0.6	1.2	19 738 588	18 428 742
Portugal	48	0.9	41	0.8	1.3	5 489 510	5 148 203
Romania	39	0.4	25	0.2	1.6	11 011 093	10 451 093
Slovakia	22	0.8	16	0.6	1.5	2 787 987	2 636 938
Slovenia	7	0.7	2	0.2	3.6	1 032 869	1 014 107
Spain	196	0.9	206	0.9	1.0	23 316 596	22 672 420
Sweden	31	0.7	37	0.8	0.9	4 691 668	4 649 014
United Kingdom	521	1.7	512	1.6	1.1	31 516 708	30 491 340
EU	1 956	0.8	1 786	0.7	1.2	252 581 088	240 960 736
Iceland	2	1.3	0	0	0	157 694	159 936
Norway	19	0.8	20	0.8	1.0	2 431 447	2 426 752
EU/EEA	1 977	0.8	1 806	0.7	1.2	255 170 224	243 547 424

Note: Aggregated data, unknown and missing values were excluded

Table B8. Notification rate (per 100 000) and total number of reported invasive meningococcal disease cases by age group and country, EU/EEA, 2010

Age group (years)	< 1		1-4		5-9		10-14		15-19		20-24		25-44		45-64		65+	
Country	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)
Austria	11	14.5	17	5.4	1	0.3	9	2.0	21	4.2	7	1.3	7	0.3	8	0.4	4	0.3
Belgium	13	10.3	16	3.2	10	1.7	4	0.7	23	3.5	1	0.2	6	0.2	4	0.1	7	0.4
Cyprus	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.6	0	0.0	0	0.0	0	0.0
Czech Republic	8	6.7	13	2.9	2	0.4	5	1.1	12	2.0	5	0.7	11	0.3	2	0.1	2	0.1
Denmark	4	6.3	18	6.9	2	0.6	3	0.9	16	4.6	4	1.2	2	0.1	7	0.5	10	1.1
Estonia	0	0.0	0	0.0	1	1.5	0	0.0	0	0.0	0	0.0	1	0.3	0	0.0	0	0.0
Finland	4	6.6	5	2.1	0	0.0	1	0.3	8	2.4	2	0.6	4	0.3	4	0.3	6	0.7
France	69	8.4	110	3.4	38	1.0	27	0.7	72	1.8	57	1.4	56	0.3	50	0.3	32	0.3
Germany	51	7.7	52	1.9	29	0.8	18	0.5	79	1.8	40	0.8	36	0.2	33	0.1	47	0.3
Greece	0	0.0	12	2.7	3	0.6	3	0.6	10	1.8	2	0.3	4	0.1	6	0.2	0	0.0
Hungary	6	6.3	7	1.8	2	0.4	1	0.2	8	1.3	6	0.9	4	0.1	2	0.1	1	0.1
Ireland	30	40.7	44	15.9	8	2.6	4	1.4	12	4.4	1	0.4	4	0.3	4	0.4	7	1.4
Italy	26	4.6	27	1.2	18	0.6	9	0.3	15	0.5	5	0.2	24	0.1	16	0.1	10	0.1
Latvia	0	0.0	2	2.2	0	0.0	0	0.0	0	0.0	0	0.0	2	0.3	2	0.3	0	0.0
Lithuania	13	35.6	21	16.5	5	3.3	0	0.0	2	0.8	1	0.4	3	0.3	1	0.1	2	0.4
Luxembourg	0	0.0	0	0.0	0	0.0	0	0.0	1	3.4	0	0.0	0	0.0	0	0.0	0	0.0
Malta	1	24.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.9	0	0.0
Netherlands	25	13.5	35	4.7	12	1.2	4	0.4	20	2.0	9	0.9	8	0.2	18	0.4	12	0.5
Poland	53	12.7	73	4.8	16	0.9	6	0.3	24	1.0	12	0.4	20	0.2	17	0.2	7	0.1
Portugal	18	18.2	25	5.9	15	2.7	0	0.0	6	1.1	2	0.3	7	0.2	5	0.2	10	0.5
Romania	16	7.3	13	1.5	6	0.6	4	0.4	3	0.2	3	0.2	2	0.0	12	0.2	5	0.2
Slovakia	6	9.8	10	4.6	4	1.5	4	1.4	2	0.5	3	0.7	4	0.2	5	0.4	0	0.0
Slovenia	2	9.2	3	3.7	0	0.0	1	1.1	2	1.9	1	0.8	0	0.0	0	0.0	0	0.0
Spain	75	14.7	110	5.6	35	1.5	13	0.6	27	1.2	23	0.9	45	0.3	41	0.4	33	0.4
Sweden	1	0.9	8	1.8	0	0.0	0	0.0	17	2.7	4	0.7	10	0.4	14	0.6	14	0.8
United Kingdom	276	35.4	279	9.2	65	1.9	34	1.0	102	2.6	57	1.3	69	0.4	87	0.6	77	0.8
EU	708	13.4	900	4.3	272	1.1	150	0.6	482	1.7	246	0.8	329	0.2	339	0.3	286	0.3
Iceland	0	0.0	0	0.0	0	0.0	0	0.0	2	8.4	0	0.0	0	0.0	0	0.0	0	0.0
Norway	1	1.6	6	2.5	0	0.0	2	0.6	17	5.3	4	1.3	1	0.1	4	0.3	4	0.6
EU/EEA	709	13.3	906	4.3	272	1.1	152	0.6	501	1.7	250	0.8	330	0.2	343	0.3	290	0.3

Note: BG is not included due to aggregated data report.

Table B9. Number of cases and notification rates of confirmed invasive meningococcal disease cases, by serogroup, EU/EEA countries, 2007–2010

	2007		2008		2009		2010	
Serogroup	Number of cases	Notification rate (100 000)	Number of cases	Notification rate (100 000)	Number of cases	Notification rate (100 000)	Number of cases	Notification rate (100 000)
A	8	0.0	17	0.0	23	0.0	13	0.0
B	3 400	0.7	3 273	0.7	3 050	0.6	2 443	0.5
C	676	0.1	665	0.1	574	0.1	489	0.1
NGA	58	0.0	49	0.0	57	0.0	43	0.0
W135	105	0.0	77	0.0	82	0.0	78	0.0
Y	119	0.0	136	0.0	187	0.0	196	0.0
Other	8	0.0	10	0.0	16	0.0	13	0.0
Unk	572	0.1	338	0.1	322	0.1	278	0.1
Total	4 946	1.0	4 565	1.0	4 311	0.9	3 553	0.7

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

Table B10. Total number of reported invasive meningococcal disease cases by serogroup and by country, 2010

Country	A	B	C	29E	NGA	O	W135	X	Y	Total known serogroup
Austria	0	47	27	0	0	0	4	0	4	85
Belgium	0	76	10	0	0	0	4	1	4	96
Cyprus	0	1	0	0	0	0	0	0	0	1
Czech Republic	0	38	7	0	0	0	0	0	4	60
Denmark	0	36	26	0	0	0	0	1	1	66
Estonia	1	1	0	0	0	0	0	0	0	2
Finland	0	14	4	0	1	0	1	0	13	34
France	1	368	82	0	2	0	11	3	27	510
Germany	4	236	74	0	1	1	11	0	17	384
Greece	0	41	1	0	3	0	0	0	0	55
Hungary	0	16	17	0	0	0	0	0	0	37
Ireland	0	93	4	0	0	0	1	0	0	98
Italy	1	74	21	0	0	0	3	0	11	150
Latvia	0	5	0	0	0	0	0	0	0	5
Lithuania	0	15	0	0	0	0	1	0	0	48
Luxembourg	0	1	0	0	0	0	0	0	0	1
Malta	0	2	0	0	0	0	0	0	0	2
Netherlands	0	104	10	1	0	0	5	0	10	143
Poland	0	114	92	0	0	0	1	0	5	228
Portugal	2	48	6	0	3	0	0	0	0	60
Romania	1	13	2	0	0	0	1	0	1	52
Slovakia	0	23	8	0	0	0	0	0	0	37
Slovenia	0	5	2	0	0	1	0	0	1	9
Spain	3	453	84	2	32	6	14	0	7	617
Sweden	0	15	24	0	0	0	5	0	23	67
United Kingdom	0	857	20	2	4	1	25	0	70	1008
EU Total	13	2 697	521	5	46	9	87	5	198	3 581
Iceland	0	2	0	0	0	0	0	0	0	2
Norway	0	13	10	0	1	0	2	0	13	39
EU/EEA	13	2 711	531	5	46	9	89	5	211	3 620

Table B11. Age-group-specific notification rates (per 100 000) of serogroup B invasive meningococcal disease cases, EU/EEA countries, 2010

	<1 years		1-4 years		5-9 years		10-14 years		15-19 years		20-24 years		25-44 years		45-64 years		65+ years	
Country	**n**	**NR (100 000)**	**n**	**NR (100 000)**	**n**	**NR (100 000)**	**n**	**NR (100 000)**	**n**	**NR (100 000)**	**n**	**NR (100 000)**	**n**	**NR (100 000)**	**n**	**NR (100 000)**	**n**	**NR (100 000)**
Austria	8	10.6	7	2.2	1	0.3	6	1.4	10	2.0	4	0.8	6	0.3	5	0.2	0	8
Belgium	10	7.9	16	3.2	8	1.3	4	0.7	20	3.1	1	0.2	2	0.1	2	0.1	3	10
Cyprus	0	0	0	0	0	0	0	0	0	0	1	1.6	0	0	0	0	0	0
Czech Republic	6	5.1	8	1.8	1	0.2	4	0.9	5	0.8	5	0.7	8	0.3	0	0	1	6
Denmark	2	3.2	10	3.8	2	0.6	2	0.6	9	2.6	2	0.6	2	0.1	2	0.1	5	2
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3	0	0	0	0
Finland	3	5.0	3	1.3	0	0	0	0	2	0.6	2	0.6	0	0	3	0.2	1	3
France	58	7.1	89	2.8	19	0.5	17	0.4	53	1.3	35	0.9	41	0.2	36	0.2	20	58
Germany	39	5.9	38	1.4	22	0.6	11	0.3	47	1.1	29	0.6	18	0.1	17	0.1	15	39
Greece	0	0	8	1.8	2	0.4	3	0.6	7	1.2	2	0.3	3	0.1	5	0.2	0	0
Hungary	3	3.2	2	0.5	1	0.2	1	0.2	4	0.7	3	0.5	2	0.1	0	0	0	3
Ireland	28	38.0	34	12.3	5	1.6	3	1.0	10	3.6	1	0.4	4	0.3	4	0.4	4	28
Italy	18	3.2	14	0.6	12	0.4	3	0.1	5	0.2	2	0.1	11	0.1	7	0.0	2	18
Latvia	0	0	2	2.2	0	0	0	0	0	0	0	0	1	0.2	1	0.2	0	0
Lithuania	1	2.7	5	3.9	3	2.0			1	0.4	1	0.4	2	0.2	1	0.1	1	1
Luxembourg	0	0	0	0	0	0	0	0	1	3.4	0	0	0	0	0	0	0	0
Malta	1	24.0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.9	0	1
Netherlands	23	12.5	29	3.9	11	1.1	4	0.4	10	1.0	9	0.9	3	0.1	9	0.2	6	23
Poland	38	9.1	39	2.5	7	0.4	3	0.2	6	0.2	6	0.2	6	0.1	6	0.1	3	38
Portugal	13	12.1	12	2.9	9	1.6	0	0	4	0.7	1	0.2	2	0.1	3	0.1	4	12
Romania	6	2.7	2	0.2	1	0.1	0	0	0	0	0	0	0	0	2	0.0	2	6
Slovakia	5	8.2	7	3.2	2	0.8	3	1.0	1	0.3	2	0.5	2	0.1	1	0.1	0	5
Slovenia	2	9.2	2	2.5	0	0	0	0	0	0	1	0.8	0	0	0	0	0	2
Spain	64	12.6	93	4.8	27	1.2	12	0.6	19	0.9	13	0.5	20	0.1	23	0.2	22	64
Sweden	0	0	3	0.7	0	0	0	0	1	0.2	1	0.2	5	0.2	1	0.0	4	0
United Kingdom	246	31.5	259	8.6	56	1.6	27	0.8	79	2.0	43	1.0	50	0.3	61	0.4	36	246
EU	573	5.4	682	1.6	189	0.4	103	0.2	294	0.5	164	0.3	189	0.1	190	0.1	129	573
Iceland	0	0	0	0	0	0	0	0	2	8.4	0	0	0	0	0	0	0	0
Norway	0	0	2	0.8	0	0	2	0.6	5	1.6	2	0.7	0	0	2	0.2	0	0
EU/EEA	573	5.4	684	1.6	189	0.4	105	0.2	301	0.5	166	0.3	189	0.1	192	0.1	129	573

Table B12. Age group specific notification rates (per 100 000) of serogroup C invasive meningococcal disease cases, in countries with MCC and without MCC vaccination, EU/EEA countries, 2010 (498).

	<1 years		1-4 years		5-9 years		10-14 years		15-19 years		20-24 years		25-44 years		45-64 years		65+ years	
Country	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)
Austria	2	2.6	9	2.8	0	0	2	0.5	8	1.6	1	0.2	1	0	1	0	3	0.2
Belgium	1	0.8	0	0	1	0.2	0	0	1	0.2	0	0	3	0.1	2	0.1	1	0.1
Czech Republic	2	1.7	1	0.2	0	0	0	0	3	0.5	0	0	1	0	0	0	0	0
Denmark	2	3.2	8	3.0	0	0	0	0	7	2.0	2	0.6	0	0	3	0.2	4	0.4
Finland	0	0	2	0.8	0	0	1	0.3	0	0	0	0	1	0.1	0	0	0	0
France	7	0.9	12	0.4	11	0.3	7	0.2	11	0.3	15	0.4	7	0	8	0.1	4	0
Germany	9	1.4	10	0.4	2	0.1	4	0.1	16	0.4	6	0.1	11	0.1	8	0	8	0.1
Greece	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Hungary	2	2.1	5	1.3	1	0.2	0	0	3	0.5	3	0.5	1	0	2	0.1	0	0
Ireland	0	0	0	0	2	0.6	0	0	1	0.4	0	0	0	0	0	0	1	0.2
Italy	4	0.7	3	0.1	0	0	2	0.1	5	0.2	0	0	5	0	2	0	0	0
Netherlands	2	1.1	1	0.1	0	0	0	0	2	0.2	0	0	3	0.1	1	0	1	0
Poland	10	2.4	31	2.0	7	0.4	3	0.2	14	0.6	5	0.2	12	0.1	7	0.1	3	0.1
Portugal	0	0	0	0	2	0.4	0	0	0	0	0	0	1	0	1	0	2	0.1
Romania	0	0	1	0.1	0	0	0	0	1	0.1	0	0	0	0	0	0	0	0
Slovakia	0	0	2	0.9	2	0.8	1	0.3	1	0.3	0	0	1	0.1	1	0.1	0	0
Slovenia	0	0	1	1.2	0	0	1	1.1	0	0	0	0	0	0	0	0	0	0
Spain	1	0.2	5	0.3	5	0.2	1	0.1	1	0	5	0.2	16	0.1	12	0.1	6	0.1
Sweden	0	0	4	0.9	0	0	0	0	9	1.4	2	0.3	2	0.1	5	0.2	2	0.1
United Kingdom	1	0.1	4	0.1	2	0.1	0	0	1	0	0	0	8	0.1	1	0	3	0
EU	43	0.4	99	0.2	35	0.1	22	0	84	0.2	39	0.1	74	0	54	0	38	0
Norway	1	1.6	2	0.8	0	0	0	0	6	1.9	0	0	0	0	1	0.1	0	0
EU/EEA	44	0.4	101	0.3	35	0.1	22	0	90	0.2	39	0.1	74	0	55	0	38	0
Countries with MCC	18	0.6	23	0.2	14	0.1	7	0.1	27	0.2	11	0.1	48	0.1	27	0	22	0
Countries without MCC	25	1.2	76	1.0	21	0.2	15	0.2	57	0.5	28	0.2	26	0.1	27	0.1	16	0.1

Table B13. Notification rate (per 100 000) of serogroup B invasive meningococcal disease cases by year and age group in countries with consistent reporting, 2007–2010

Age group	2007		2008		2009		2010	
	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)
<1	666	13.5	934	19.2	820	16.3	550	11.4
1-4	1026	5.3	733	3.8	680	3.5	653	3.3
5-9	274	1.1	241	1.0	246	1.0	178	0.8
10-14	144	0.6	136	0.6	146	0.6	101	0.5
15-19	412	1.5	398	1.4	391	1.5	290	1.1
20-24	188	0.7	186	0.6	191	0.6	157	0.6
25-44	248	0.2	230	0.2	206	0.2	185	0.1
45-64	222	0.2	246	0.2	215	0.2	182	0.2
>=65	144	0.2	147	0.2	138	0.2	123	0.2
Unknown	76	-	22	-	17	0	24	-

Table B14. Notification rate (per 100 000) of serogroup C invasive meningococcal disease cases by year and age group in countries with consistent reporting, 2007–2010.

Age group	2007		2008		2009		2010	
	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)	n	NR (100 000)
<1	49	1.2	57	1.4	57	1.5	42	1.0
1-4	127	0.7	96	0.6	92	0.5	100	0.5
5-9	56	0.3	55	0.3	43	0.2	35	0.2
10-14	58	0.4	40	0.2	58	0.3	22	0.1
15-19	128	0.5	132	0.5	89	0.4	88	0.3
20-24	56	0.2	65	0.2	52	0.3	39	0.2
25-44	100	0.1	98	0.1	75	0.1	71	0.1
45-64	52	0.0	70	0.1	62	0.1	54	0.0
>=65	46	0.1	51	0.1	45	0.1	37	0.1
Unknown	4	-	1	-	1	-	1	-

Table B15. Percentage of virulent meningococcal clonal complexes, by serogroup, EU/EEA, 2010

ResultMLST1	Serogroup B		Serogroup C		NGA		Other		Unknown		Serogroup W135		Serogroup Y		Total	
	(n)	(%)	(n)	%	n	%	n	%	n	%	n	%	n	%	n	%
ST-41/44	168	32.4	14	8.4	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	183	23.8
ST-32	125	24.1	3	1.8	0	0.0	1	100.0	0	0.0	0	0.0	0	0.0	129	16.8
ST-11	6	1.2	97	58.4	0	0.0	0	0.0	0	0.0	1	6.3	0	0.0	104	13.5
ST-269	73	14.1	9	5.4	0	0.0	0	0.0	2	66.7	0	0.0	0	0.0	84	10.9
ST-23	1	0.2	0	0.0	1	20.0	0	0.0	0	0.0	1	6.3	46	75.4	49	6.4
ST-213	43	8.3	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	44	5.7
ST-103	5	1.0	19	11.4	0	0.0	0	0.0	0	0.0	0	0.0	1	1.6	25	3.2
ST-162	24	4.6	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	25	3.2
ST-18	20	3.9	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	21	2.7
ST-461	18	3.5	2	1.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	20	2.6
ST-60	12	2.3	1	0.6	1	20.0	0	0.0	1	33.3	0	0.0	0	0.0	15	1.9
ST-22	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	13	81.3	1	1.6	15	1.9
ST-167	0	0.0	2	1.2	0	0.0	0	0.0	0	0.0	0	0.0	9	14.8	11	1.4
ST-865	7	1.4	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	1	1.6	9	1.2
ST-334	0	0.0	9	5.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	9	1.2
Total	503	97.1	160	96.4	3	60.0	1	100.0	3	100.0	15	93.8	58	95.1	743	96.5

Table B16. Distribution (%) of clinical presentation of invasive meningococcal disease by country, EU/EEA, 2010

	Meningitis		Septicaemia		Meningitis and septicaemia		Other		Total
Country	n	%	n	%	n	%	n	%	n
Austria	28	33.	38	45	19	22	0	0	85
Cyprus	1	100.0	0	0	0	0	0	0	1
Denmark	35	53	14	21	12	18	5	8	66
Estonia	2	100	0	0	0	0	0	0	2
Finland	0	0	21	70	9	30	0	0	30
Germany	216	60	107	30	39	11	0	0	362
Greece	24	45	12	23	17	32	0	0	53
Hungary	18	49	4	11	15	41	0	0	37
Ireland	22	20	47	44	39	36	0	0	108
Italy	83	55	38	25	29	19	0	0	150
Latvia	3	38	2	25	2	25	1	13	8
Lithuania	4	20	16	80	0	0	0	0	20
Luxembourg	1	100	0	0	0	0	0	0	1
Malta	0	0	2	100	0	0	0	0	2
Norway	9	27	14	41	9	27	2	6	34
Poland	80	35	93	41	54	24	1	0	228
Portugal	44	66	23	34	0	0	0	0	67
Romania	41	64	5	8	6	9	12	19	64
Slovakia	33	87	1	3	0	0	4	11	38
Slovenia	9	100	0	0	0	0	0	0	9
Spain	142	36	192	49	50	13	9	2	393
United Kingdom	37	39	29	30	19	20	11	12	96
EU/EEA Total	832	45	658	36	319	17	45	2	1 854

Table B17. Case–fatality ratio and total number of invasive meningococcal disease cases, by country, 2010

Country	Number of deaths	Number of cases	Case fatality rate
Austria	11	85	12.9
Belgium	0	96	0
Cyprus	0	1	0
Czech Republic	5	60	8.3
Denmark	7	67	10.5
Estonia	0	2	0
France	53	522	10.2
Germany	31	385	8.0
Greece	3	56	5.4
Hungary	4	37	10.8
Ireland	5	114	4.4
Italy	10	150	6.7
Latvia	1	8	13.0
Lithuania	6	50	12.0
Luxembourg	0	1	0
Malta	0	2	0
Netherlands	12	143	8.4
Poland	23	230	10
Portugal	2	90	2.2
Romania	12	64	18.8
Slovakia	3	38	7.9
Slovenia	1	9	11.1
Spain	45	404	11.1
Sweden	7	68	10.3
United Kingdom	56	1 046	5.4
EU	297	3 728	8.0
Iceland	0	2	0
Norway	2	39	5.1
EU/EEA	299	3 769	7.9

Table B18. Case–fatality ratio of confirmed invasive meningococcal disease cases by serogroup and clinical presentation, EU/EEA countries, 2010

Clinical presentation	Number of deaths	Number of cases	Case–fatality ratio (%)
Meningitis	34	796	4.3
Meningitis and septicaemia	17	305	5.6
Septicaemia	109	637	17.1
Others	0	37	0
Serogroup	**Number of deaths**	**Number of cases**	**Case–fatality ratio (%)**
A	2	13	15.4
B	164	2711	6.1
C	69	531	13.0
NGA	8	46	17.4
W135	8	89	9.0
Y	20	211	9.5
Others	2	19	10.5

Table B19. Vaccination status of reported invasive meningococcal disease cases due to serogroup C, by country, 2010

Country	Fully vaccinated		Partly vaccinated		Not vaccinated		Unknown		Total
	n	%	n	%	n	%	n	%	
Austria	1	3.7	1	3.7	9	33.3	16	59.3	27
Belgium	-	-	-	-	-	-	10	100	10
Czech Republic	0	0	1	14.3	6	85.7	0	0	7
Denmark	0	0	0	0	18	69.2	8	30.8	26
Finland	-	-	-	-	-	-	4	100	4
France*	-	-	-	-	26	31.7	56	68.3	82
Germany	-	-	-	-	-	-	74	100	74
Greece	0	0	0	0	1	100	0	0	1
Hungary	0	0	0	0	17	100	0	0	17
Ireland	0	0	0	0	4	100	0	0	4
Italy	1	4.8	0	0	8	38.1	12	57.1	21
Netherlands	1	10	0	0	5	50	4	40	10
Norway	0	0	0	0	5	50	5	50	10
Poland	0	0	0	0	92	100	0	0	92
Portugal	1	16.7	1	16.7	2	33.3	2	33.3	6
Romania	0	0	0	0	2	100	0	0	2
Slovakia	0	0	0	0	8	100	0	0	8
Slovenia	0	0	0	0	2	100	0	0	2
Spain	6	7.1	2	2.4	17	20.2	59	70.2	84
Sweden	0	0	0	0	6	25	18	75	24
United Kingdom	3	15	0	0	15	75	2	10	20
EU/EEA Total	13	2.4	5	0.9	217	40.9	296	55.7	531

**MCC introduced in vaccination schedule in 2010.*

Table B20. Countries with routine conjugate meningococcal group C vaccination programmes in European countries

Country	Routine schedule	Year introduced	Catch-up	Year undertaken
Belgium* ¤	15 months	2002	1 year–17 years	2001–2004
Cyprus	12–13 months	2008	-	-
Germany	12–13 months, one dose in the 2nd year of life	2006	General recommendation to complete all outstanding vaccinations, including MCC in older children	
Greece	2, 4, 15–18 months one dose in the 2nd year of life	2007	No information	
Iceland	6–8 months	2002	6 month–19 years	Oct 2002–Oct 2003
Italy ¤	Between 2 months and 2 years	2005	-	-
Ireland ¤	4, 6 and 13 months one dose in the 2nd year of life	2000	< 23 years	Oct 2000–March 2002
France*	12-24 month	2010	1-24 years, year undertaken	the duration of catch-up was not limited and this strategy will be reevaluated according to epidemiology
Luxembourg	13 months	2001	1-5 years and 15-19 years	On-going for unvaccinated adolescents
Netherlands	14 months	2002	1 year–18 years	June 2002–Nov 2002
Portugal *	3, 5 and 15 months	2006	< 10 years	Jan 2006–Dec 2006
			10 years–18 years	Jan 2007–Dec 2007
Spain ¤	2, 6 months booster dose from the age of 12 months	2000	7 month–19 years	2001–2004
UK ¤	3, 4, 12 months	1999	< 18 years	November 1999–2000 December 2001–2002
			19 years–25 years	

Source: EUVAC.NET (2010); Report EU-IBIS 2006.
Historical changes: BE: 2002–2006: 12 months; IR: 2000–2006: 2, 4, 6 months; UK: 1999–2006: 2, 3, 4 months; ES: 2000–2006: 2, 4, 6 months; IT: vaccination for specific groups; PT: Since 2012 routine schedule is 1 dose at 12 months; BE, FR: Country specific information in 2012.

Table B21. Conjugate meningococcal group C vaccination programmes in European countries, countries with voluntary vaccination, 2008–2009.

Country	Given to travellers	Contacts of cases	Outbreak control	Underlying conditions	Other	Year introduced
Austria	Yes	Yes	Yes	Yes	On request	-
Czech Republic	Yes	Yes	Yes		On request	2001
France*	Yes	Yes	Yes	Yes*		2010
Hungary	Yes		Yes	Yes	On request	2000
Norway	Yes	Yes				-
Poland	-	Yes	Yes	Yes	Generally recommended	-
Sweden	-	-	Yes	-	On request	-

Source: EUVAC.NET 2010; Report EU-IBIS 2006; countries specific comments.

**Country specific comment: Quadrivalent Conjugate Meningococcal Vaccines*