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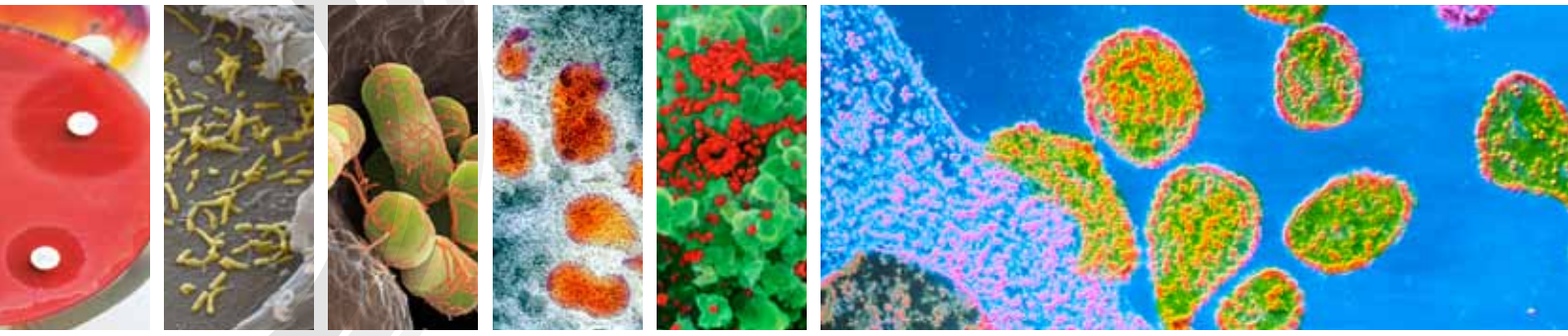
SURVEILLANCE REPORT



Annual epidemiological report

Vaccine-preventable diseases – invasive bacterial diseases

2014

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ECDC SURVEILLANCE REPORT

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2014

This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Catalin Albu, Sergio Brusin, Joanna Gomes Dias and Bruno Ciancio.

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In order to facilitate more timely publication, this year's edition of the Annual Epidemiological Report is being first published a disease group at a time and will later be compiled into one comprehensive report. This report presents the epidemiological situation for invasive bacterial diseases as of 2012. Other vaccine-preventable diseases are dealt with in a separate section, available at: http://www.ecdc.europa.eu/en/publications/Publications/AER-2014-VPD-FINAL.pdf.

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Stockholm, February 2015

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Abbreviations

ASR	Age standardised rate
Hib vaccine	*Haemophilus influenzae* type b vaccine
IBD	invasive bacterial disease
IMD	invasive meningococcal disease
IPD	invasive pneumococcal disease
MCC	meningococcal C conjugate
NGA	non-groupable
Unk	unknown

Introduction

A note to the reader

The Annual Epidemiological Report 2014 gives an overview of the epidemiology of communicable diseases of public health significance in Europe, drawn from surveillance information on the 52 communicable diseases and health issues for which surveillance is mandatory in the European Union (EU) and European Economic Area (EEA) countries.[i] [ii] [iii] [iv]

In order to facilitate more timely publication, this year's edition of the Annual Epidemiological Report is being first published a disease group at a time and will later be compiled into one comprehensive report. This report presents the epidemiological situation for respiratory tract infections - tuberculosis as of 2012 and describes the statistical and epidemiological methods used.

Produced annually, the report is intended for policymakers and health sector leaders, epidemiologists, scientists and the wider public. It is hoped that readers will find it a useful overview and reference to better understand the present situation in relation to communicable diseases in Europe. It should also usefully assist policymakers and health leaders in making evidence-based decisions to plan and improve programmes, services and interventions for preventing, managing and treating these diseases.

This year's edition of the report draws on surveillance data for 2012, submitted by Member States to the European Surveillance System. The report gives an outline description of the epidemiology for each disease, in a standard format, covering the years 2008–2012. In addition, updates from epidemic intelligence in relation to emerging public health threats for 2013 are given, by disease as relevant. Information on these is either directly reported to ECDC through Member State notifications on the Early Warning and Response System (EWRS), according to defined criteria[v], or found through active screening of various sources, including national epidemiological bulletins and international networks, and various additional formal and informal sources. In-depth reviews of the epidemiology of particular diseases (e.g. tuberculosis, HIV) or disease groups (e.g. food- and waterborne diseases) are published separately, sometimes in collaboration with other European agencies or the World Health Organization's Regional Office for Europe. These are referenced, for convenience, with the description of each disease. In addition, further information relating to most of the diseases reported here is available on the ECDC website health topics pages at http://ecdc.europa.eu/en/healthtopics.

The reader will appreciate that most surveillance systems capture only a proportion of the cases occurring in their countries. Some cases of disease remain undiagnosed ('under-ascertainment'), and some are diagnosed but not reported to public health authorities ('underreporting'). The pattern of this under-ascertainment and underreporting varies by disease and country, involving a complex mix of healthcare-seeking behaviour, access to health services, availability of diagnostic tests, reporting practices by doctors and others, and the operation of the surveillance system itself.

The direct comparison of disease rates between countries should therefore be undertaken with caution. The reader should be aware that in most cases, differences in case rates reflect not only differences in the occurrence of the disease, but also in systematic differences in health and surveillance systems as described here.

[i] 2000/96/EC: Commission Decision of 22 December 1999 on the communicable diseases to be progressively covered by the Community network under Decision No 2119/98/EC of the European Parliament and of the Council. Official Journal, OJ L 28, 03.02.2000, p. 50–53.

[ii] 2003/534/EC: Commission Decision of 17 July 2003 amending Decision No 2119/98/EC of the European Parliament and of the Council and Decision 2000/96/EC as regards communicable diseases listed in those decisions and amending Decision 2002/253/EC as regards the case definitions for communicable diseases. Official Journal, OJ L 184, 23.07.2003, p. 35–39.

[iii] 2007/875/EC: Commission Decision of 18 December 2007 amending Decision No 2119/98/EC of the European Parliament and of the Council and Decision 2000/96/EC as regards communicable diseases listed in those decisions. Official Journal, OJ L 344, 28.12.2007, p. 48–49.

[iv] Commission Decision 2119/98/EC of the Parliament and of the Council of 24 September 1998 setting up a network for the epidemiological surveillance and control of communicable diseases in the Community. Official Journal, OJ L 268, 03/10/1998 p. 1-7.

[v] 2009/547/EC: Commission Decision of 10 July 2009 amending Decision No 2000/57/EC on the early warning and response system for the prevention and control of communicable diseases under the Decision No 2119/98/EC of the European Parliament and of the Council. Official Journal, OJ L 181, 14.07.2009 p. 57-60.

Each year, we observe improvements in the harmonisation of systems, definitions, protocols and data at Member State and EU levels. Nevertheless, data provided by the Member States continue to show a number of inconsistencies. In several situations, the quality and comparability of the data are not optimal, and more work is planned, in conjunction with Member States, to see how best to improve this situation.

This report aims to be consistent with previously published ECDC surveillance reports for 2012 relating to specific diseases and disease groups. However, Member States update their data continually and a number have made specific corrections for this report, including corrections to data reported for earlier years. Accordingly, some minor differences will be seen when comparing the data in this report to previous Annual Epidemiological and disease-specific reports.

Description of methods

Data sources: indicator-based surveillance (disease cases)

All EU Member States and three EEA countries (Iceland, Liechtenstein and Norway) send information at least annually from their surveillance systems to ECDC relating to occurrences of cases of the 52 communicable diseases and health issues under mandatory EU-wide surveillance. Reports are sent according to case definitions established by the EU[i].

Data upload by Member States occurs continually throughout the year. In conjunction with annual ECDC reports for particular diseases or disease groups, and the consolidated annual report, ECDC issues 'data calls,' with specified end dates, to facilitate accurate and up-to-date submission of data for the previous calendar year.

The information submitted by Member States to ECDC is defined through a 'metadata set' for each disease under surveillance. The metadata set includes the case classification for the disease (particularly whether the case is confirmed or probable) according to official case definitions as determined by the European Commission. It also defines the information to be included with each case report. Most data are submitted as anonymised individual case data, but aggregated data are reported by some Member States for some diseases. Countries actively report zero cases for particular diseases, as applicable.

Data are uploaded and validated by the Member States using ECDC's online system for the collection of surveillance data, the European Surveillance System (TESSy). Member States' information specialists transform the data in their surveillance systems into an appropriate format before uploading to TESSy. System reports generated by TESSy allow Member States to review uploaded data and to make modifications where necessary. TESSy performs automatic validation and additional data validation is conducted by ECDC staff, in liaison with designated disease experts and epidemiologists in the Member States. Once the draft report is produced, it is sent to Member States' National Surveillance Coordinators for final validation. Any final corrections are uploaded to TESSy.

For each disease under surveillance, TESSy also holds a description of the key attributes of the surveillance systems for that disease in each Member State. This information is included in the report to aid the interpretation of surveillance data for each reported disease. Member States are asked to verify and update this information each year.

Data sources: event-based surveillance

The report also presents information relating to health threats identified by ECDC through epidemic intelligence activities, from formal and validated informal sources. These threats are documented and monitored by using a dedicated database, called the Threat Tracking Tool (TTT). Data analysed in this report are extracted from the TTT and the EWRS database. The analysis of monitored threats covers the period from the activation of the TTT in June 2005 until the end of 2013; EWRS entries are covered from January 2005 to the end of 2013.

The expression 'opening a threat' refers to the way ECDC assesses threats during its daily threat review meetings. ECDC experts evaluate potential threats and validate events requiring further attention or action from ECDC, based on their relevance to public health or the safety of EU citizens. The following criteria are used to open a threat and further monitor an event:

- more than one Member State is affected
- a disease is new or unknown, even if there are no cases in the EU
- there is a request from a Member State or from a third party for ECDC to deploy a response team
- there is a request for ECDC to prepare a risk assessment of the situation
- there is a documented failure in an effective control measure (vaccination, treatment or diagnosis)
- there is a documented change in the clinical/epidemiological pattern of the disease, including changes in disease severity, mode of transmission, etc.
- the event matches any of the criteria under the International Health Regulations (IHR) or EWRS.

[i] 2002/253/EC: Commission Decision of 19 March 2002 laying down case definitions for reporting communicable diseases to the Community network under Decision No 2119/98/EC of the European Parliament and of the Council. Official Journal, OJ L 86, 03.04.2002, p. 44–62.

Events are considered relevant to be reported to the EWRS if one or more of the criteria below are met. After the revised International Health Regulations (IHR) entered into force on 15 June 2007, the decision was amended, and criteria now include both IHR notifications and the need to exchange details following contact tracing.[i]

The Commission Decision on serious cross-border threats to health 'lays down rules on epidemiological surveillance, monitoring, early warning of, and combating serious cross border threats to health, including preparedness and response planning related to those activities, in order to coordinate and complement national policies'. [ii]

With reference to this Decision, the following criteria are applied for reporting to the EWRS:

- outbreaks of communicable diseases extending to more than one EU Member State
- spatial or temporal clustering of cases of a disease of a similar type if pathogenic agents are a possible cause and there is a risk of propagation between Member States within the Union
- spatial or temporal clustering of cases of disease of a similar type outside the EU if pathogenic agents are a possible cause and there is a risk of propagation to the Union
- the appearance or resurgence of a communicable disease or an infectious agent which may require timely coordinated EU action to contain it
- any IHR notification (also reported through EWRS)
- any event related to communicable diseases with a potential EU dimension necessitating contact tracing to identify infected persons or persons potentially in danger, which may involve the exchange of sensitive personal data of confirmed or suspected cases between concerned Member States.

Data analysis

General principles

All analyses are based on confirmed cases where possible. For some diseases, some Member States do not distinguish confirmed from other cases; in these situations, total case reports from these countries are used in the analyses and the country concerned is identified in a footnote to the summary table. For some diseases (e.g. tuberculosis, Legionnaires' disease), confirmed cases are defined on a specific basis, described in the relevant sections. For other diseases the reporting of only confirmed cases would result in a severe underestimation of the true disease burden, hence both probable and confirmed cases are reported. The 'month' variable used in the seasonality analyses is based on the date that the country chooses as its preferred date for reporting. This could be either date of onset of disease, date of diagnosis, date of notification, or some other date at the country's discretion.

Population data

Population data for the calculation of rates are obtained from Eurostat, the statistical office of the EU. Data for overall calculations are extracted from the Eurostat database 'Demographic balance and crude rates' (DEMO_PJAN). The population as of 1 January of each year is used. Totals per year and per country are available for all countries for 2012. For calculation of age- and gender-specific rates, the data are aggregated into the following age groups for the analyses: 0–4, 5–14, 15–24, 25–44, 45–64 and ≥65 years.

Presentation of analyses

The descriptive epidemiology for each disease is set out as a summary table by country and supplementary figures describing overall epidemiology at EU/EEA level. These include the trend for reported confirmed cases from 2007–12, age- and gender-specific rates, and occurrence by month ('seasonality'), if relevant. Additional graphs, figures and maps are used where necessary to illustrate other important aspects of the disease epidemiology in the EU and EEA.

Summary table

The summary table for each disease indicates whether the country data were reported from a surveillance system with national or lesser geographical area of coverage. The table also indicates what type of data the country submitted: case based ('C'), aggregated ('A') data or data submitted to a disease-specific network ('D').

[i] Commission Decision of 10 July 2009 amending Decision No 2000/57/EC on the early warning and response system for the prevention and control of communicable diseases under the Decision No 2119/98/EC of the European Parliament and of the Council, in Official Journal of the European Union. 2009. p. L 181: 57-9.

[ii] Commission Decision 1082/2013/EU, of 5th November 2013 of the European Parliament and the Council of 22 October 2013 on serious cross-border threats to health.in Official Journal of the European Union 2013.p.L293:1-15.

This table presents an overview of the number and rates (including age-standardised rates) of confirmed cases or total cases depending on the disease reported by the Member States surveillance systems for the period 2008–12. The total number of reported cases (independent of case classification) for 2012 is also shown. Confirmed case rates are given per 100 000 persons (the number of reported confirmed cases divided by the official Eurostat estimate of the population for that year multiplied by 100 000). Countries that made no report for a disease are excluded from the calculation for overall European rates for that disease. Country reports from systems with less than national coverage (e.g. where only some regions of the country report nationally) are also excluded from calculation of overall EU case rates.

Age-standardised rates (ASR) are calculated to facilitate comparisons between countries by adjusting for differences with respect to certain underlying population characteristics such as age. ASRs were calculated when the EU/EEA rate exceeds 1 per 100 000 population and are given per 100 000 persons. ASRs were calculated using the direct method according to the following formula:

$$ASR = \frac{\sum_{i=1}^{6}\left(r_i\, p_i\right)}{\sum_{i=1}^{6} p_i}$$

where r_i is the specific rate for the age group i in the population being studied, and p_i is the population of age group i in the standard population. The standard population considered in this report was based on the average population of the EU27 Member States for the period 2001–2010. This standard population was defined to reflect the current age structure of Europe.

Age group	Standard population
0–4	25 506 062
5–14	54 043 285
15–24	62 075 051
25–44	143 411 393
45–64	124 427 054
65+	81 889 316
Total	**491 352 161**

Aspects of descriptive epidemiology at EU/EEA level

The descriptive epidemiology for each disease for the EU and EEA region overall is described as follows:

Trends in reported number of confirmed cases. The number of confirmed cases by month, 2008–12, for the EU/EEA is presented as a figure. Countries with consistent reporting of cases or zero cases for the whole five-year period are included. A centred 12-month moving average also shows the overall trend by smoothing seasonal and random variations.

Age- and gender-specific rates for confirmed cases. Age- and gender-specific rates for the EU/EEA Member States are presented and given per 100 000 persons. It should be noted that these analyses are based only on cases for which both age and gender were reported. For some diseases this can result in exclusion of a significant proportion of cases, and the overall EU and EEA rate will be underestimated. The denominator includes the sum of the populations within the respective age–gender groups, including countries which actively reported zero cases.

Seasonal distribution of cases. For diseases where reported occurrence varies by month, a figure showing the seasonality is presented. This shows the total number of confirmed cases reported for each month in 2012, compared with the maximum, minimum and average number of cases observed for each month for the period 2008–12. These analyses include only cases for which the month of reporting is given; for some diseases this can result in exclusion of significant numbers of cases.

It will be noted that for some diseases reported numbers are too small for some or all of the above analyses to be presented.

Data protection

The data received in TESSy from Member States are subject to Regulation (EC) No 45/2001 of the European Parliament and of the Council of 18 December 2000, providing for 'the protection of individuals with regard to the processing of personal data by the Community institutions and bodies, and on the free movement of such data.' High standards of data protection consistent with these requirements are applied, supervised by the ECDC Data Protection Officer (DPO). ECDC data protection arrangements are also under the review of the European Data Protection Supervisor.

Data are made available on request to other European Agencies, Institutions and approved researchers, under procedures in accordance with the above requirements, approved by the ECDC Management Board.

Vaccine preventable diseases

Invasive *Haemophilus influenzae* disease

- Invasive *Haemophilus influenzae* disease has become rare; the notification rate in Europe was 0.49 per 100 000 population, with a slightly ascending trend which may be attributed to improved surveillance in most countries.
- Country-specific rates were highest in northern Europe and in the United Kingdom; age-specific rates were highest in children under one year and adults aged 65 years or over.
- The national immunisation schedules of all EU/EEA countries include the Hib vaccine, which has led to a progressive reduction of type b serotype infections.
- Even though there appears to be a trend towards an increase in disease due to non-capsulated (non-typeable) strains, European data is too scarce to draw conclusions on serotype replacement.
- Continued monitoring of strains, together with their associated clinical syndromes, is essential for assessing the effect of interventions.

Invasive *Haemophilus influenzae* disease is a systemic infection caused by the bacterium *Haemophilus influenzae*, a common commensal of the upper respiratory tract. Invasive disease encompasses severe syndromes including meningitis, epiglottitis, pneumonia, bacteraemia and sepsis. Non-invasive disease includes less severe upper respiratory tract infections and otitis media. *H. influenzae* was the leading cause of childhood bacterial meningitis in the pre-vaccine era.

H. influenzae is divided into non-capsulated (non-typeable) and capsulated strains. Capsulated strains are further divided into six serotypes (a-f). *H. influenzae* serotype b (Hib) is the serotype most pathogenic in humans.

Between the late 1990s and 2009, all EU/EEA countries introduced routine Hib vaccination in their early childhood vaccination schedules [1] and invasive *H. influenzae* disease has become rare in the EU/EEA.

Epidemiological situation in 2012

In 2012, 2 545 confirmed cases of invasive *Haemophilus influenzae* disease (all serotypes) were reported by 27 countries, 24 of which have surveillance systems with national coverage. Belgium, France and Spain reported data from sentinel surveillance and therefore had to be excluded from the notification rates analysis, while no confirmed cases were reported from Malta for 2012. No data were reported by Iceland, Liechtenstein or Luxembourg (Table 1). In 2012 for the first time, the Danish data were reported from a nationwide laboratory surveillance system, which was recently established [2].

The overall confirmed case notification rate was 0.49 per 100 000 population in 2012, comparable to the rates observed from 2008 to 2011, but marking a slightly ascending trend. The highest rates in 2012 were reported by Sweden (2.26 per 100 000) and Norway (1.56), followed by Finland (1.50), Denmark (1.17) and the United Kingdom (1.16). The case notification rates in 19 of 24 countries remained below one case per 100 000 population (Table 1).

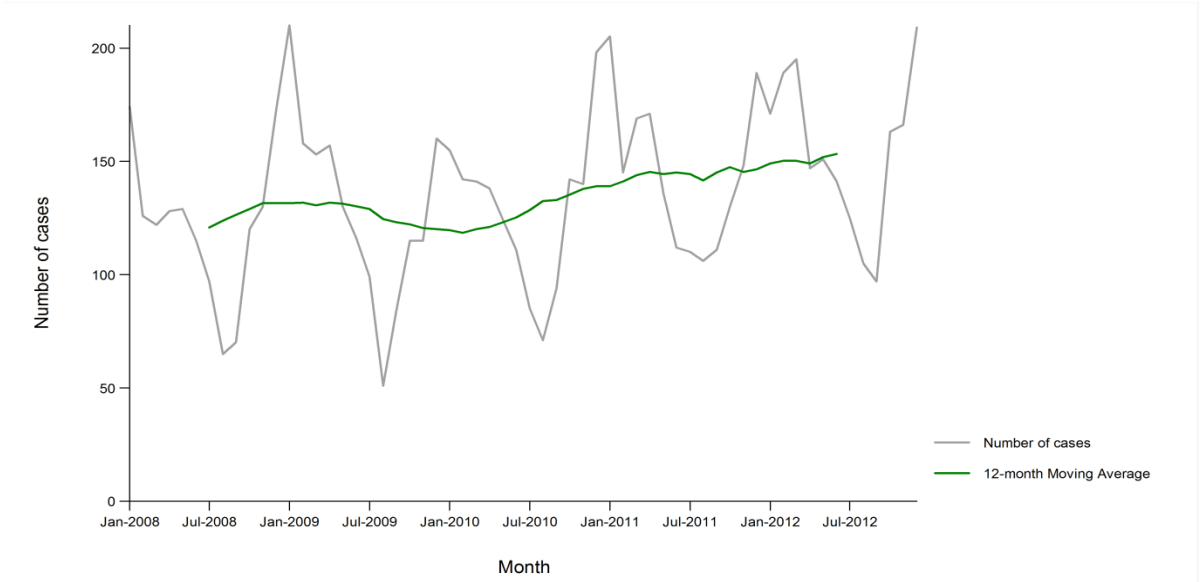
Table 1. Numbers and rates of confirmed invasive *Haemophilus influenzae* disease reported cases, EU/EEA, 2008–2012

Country	2012					2011		2010		2009		2008	
	National data	Report type	Cases	Rate	ASR	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Austria	Y	C	6	0.07	0.07	3	0.04	2	0.02	14	0.17	5	0.06
Belgium	N	C	78	-	-	96	-	68	-	76	-	49	-
Bulgaria	Y	A	3	0.04	0.05	2	0.03	10	0.14	15	0.20	14	0.19
Cyprus	Y	C	8	0.93	1.18	0	0.00	3	0.37	2	0.25	0	0.00
Czech Republic	Y	C	11	0.11	0.10	15	0.14	22	0.21	10	0.10	7	0.07
Denmark	Y	C	65	1.17	1.12	47	0.85	43	0.78	31	0.56	32	0.58
Estonia	Y	C	3	0.23	0.21	2	0.15	1	0.08	1	0.08	1	0.08
Finland	Y	C	81	1.50	1.41	66	1.23	41	0.77	47	0.88	45	0.85
France	N	C	491	-	-	492	-	371	-	417	-	442	-
Germany	Y	C	319	0.39	0.35	268	0.33	224	0.27	199	0.24	160	0.20
Greece	Y	C	6	0.05	0.05	1	0.01	4	0.04	13	0.12	4	0.04
Hungary	Y	C	4	0.04	0.04	8	0.08	5	0.05	3	0.03	6	0.06
Ireland	Y	C	41	0.90	0.99	44	0.96	26	0.57	43	0.95	22	0.49
Italy	Y	C	59	0.10	0.09	47	0.08	69	0.12	56	0.10	50	0.09
Latvia	Y	C	1	0.05	0.05	0	0.00	0	0.00	1	0.05	1	0.05
Lithuania	Y	C	3	0.10	0.11	2	0.07	1	0.03	1	0.03	3	0.09
Luxembourg	-	-	-	-	-	0	0.00	0	0.00	0	0.00	0	0.00
Malta	Y	C	0	0.00	0.00	0	0.00	2	0.48	3	0.73	0	0.00
Netherlands	Y	C	139	0.83	0.83	133	0.80	144	0.87	124	0.75	109	0.66
Poland	Y	C	35	0.09	0.09	22	0.06	25	0.07	19	0.05	28	0.07
Portugal	Y	C	45	0.43	0.41	23	0.22	10	0.10	8	0.08	5	0.05
Romania	Y	C	9	0.05	0.05	10	0.05	19	0.10	22	0.11	2	0.01
Slovakia	Y	C	3	0.06	0.06	0	0.00	3	0.06	5	0.09	4	0.07
Slovenia	Y	C	18	0.88	0.83	22	1.07	15	0.73	18	0.89	12	0.60
Spain	N	C	90	-	-	77	-	78	-	53	-	73	-
Sweden	Y	C	214	2.26	2.09	203	2.16	179	1.92	146	1.58	163	1.78
United Kingdom	Y	C	735	1.16	1.13	746	1.19	622	1.00	742	1.20	773	1.26
EU Total	**-**	**-**	**2467**	**0.48**	**0.46**	**2329**	**0.44**	**1987**	**0.39**	**2069**	**0.41**	**2010**	**0.39**
Iceland	-	-	-	-	-	2	0.63	0	0.00	0	0.00	0	0.00
Liechtenstein	-	-	-	-	-	-	-	-	-	-	-	-	-
Norway	Y	C	78	1.56	1.64	85	1.73	89	1.83	71	1.48	75	1.58
EU/EEA Total	**-**	**-**	**2545**	**0.49**	**0.47**	**2416**	**0.46**	**2076**	**0.41**	**2140**	**0.42**	**2085**	**0.40**

ASR: Age standardised rate

Source: Country reports; Y: Yes; N: No; A: Aggregated data report; C: Case-based data report; –: No report; U: Unspecified.

Figure 1. Distribution of confirmed invasive *Haemophilus influenzae* disease reported cases, EU/EEA, 2008–2012



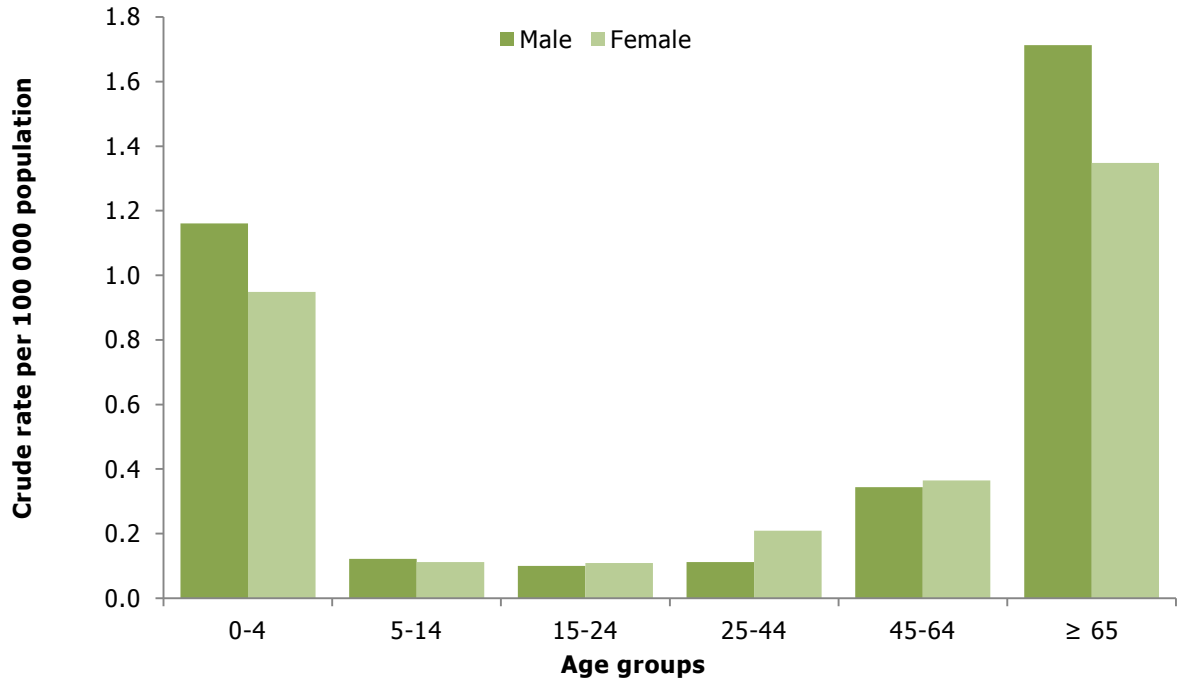
Source: Country reports from Austria, Cyprus, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden and United Kingdom.

Age and gender distribution

In 2012, invasive *Haemophilus influenzae* disease was predominantly found in young children and the elderly (Figure 2), with a notification rate of 0.97 confirmed cases per 100 000 population in children under five years of age (4.2 in children under one year of age, data not shown) and 1.50 confirmed cases per 100 000 population in adults aged 65 years or older. For both age groups, higher rates were observed in males. High notification rates among adults aged 65 and older were reported from Sweden (7.45), Norway (6.12), Cyprus (6.34) and Finland (5.21).

The overall notification rate was 0.49 per 100 000 population for males and 0.47 for females, with a male-to-female ratio of 1.02:1.

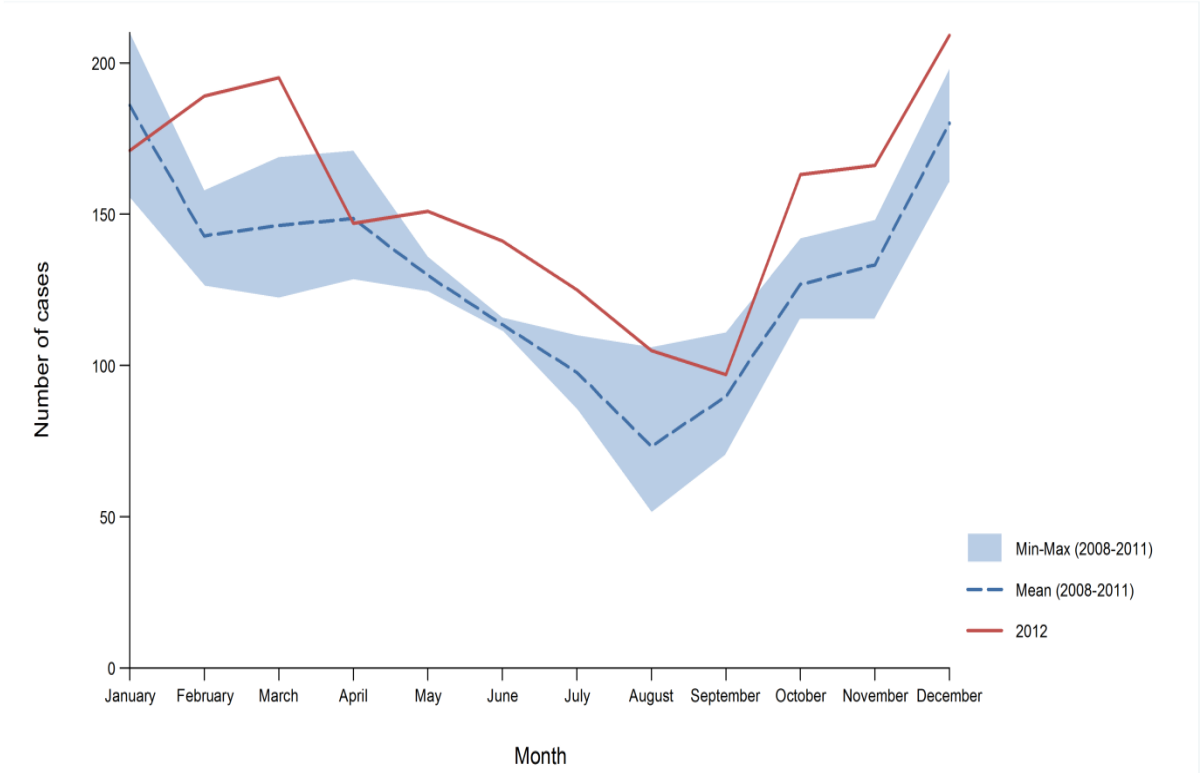
Figure 2. Rates of confirmed invasive *Haemophilus influenzae* disease reported cases by age and gender, EU/EEA, 2012



Seasonality

The distribution of invasive *Haemophilus influenzae* cases by month follows a seasonal pattern, with the highest number of reported cases in the winter months, followed by a steady decrease until August and an increasing trend towards the end of the year. Compared to previous years, a higher peak was seen in March than April, however the number of reported cases was small and this peak may be due to random variation (Figure 3).

Figure 3. Seasonal distribution of confirmed invasive *Haemophilus influenzae* disease reported cases, EU/EEA, 2008-2012



Source: Country reports from Austria, Cyprus, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden and United Kingdom.

Enhanced surveillance in 2012

Enhanced surveillance enables additional variables to be collected such as serotype and vaccination status. Of the 2 545 reported confirmed cases of invasive *H. influenzae* disease, only 1 352 (53.6%) included information on the isolate serotype. Of these, non-capsulated isolates made up 76.8% of cases (n=1038), followed by non-b serotypes (15.2%, n=206). Overall, there was an upward trend in non-capsulated strains; serotype b infections have remained constantly low, with a slightly decreasing trend (Figure 4). Figure 5 shows that the highest proportion of cases due to serotype b is observed in cases under 15 years of age.

Vaccination status was unknown in 58.3% (n=63) of all cases of serotype b invasive *H. influenzae* disease. The completeness of this variable needs to be improved for any conclusions to be drawn.

Figure 4. Rates of confirmed invasive *Haemophilus influenzae* disease reported cases by serotype, EU/EEA, 2008–2012 (n=1 352)

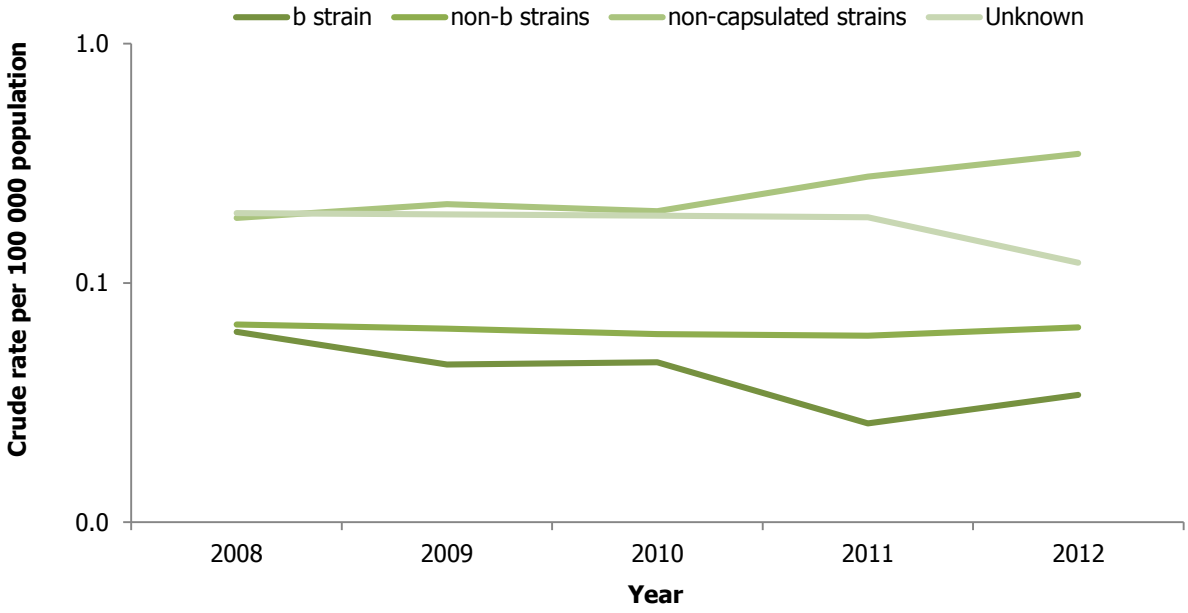
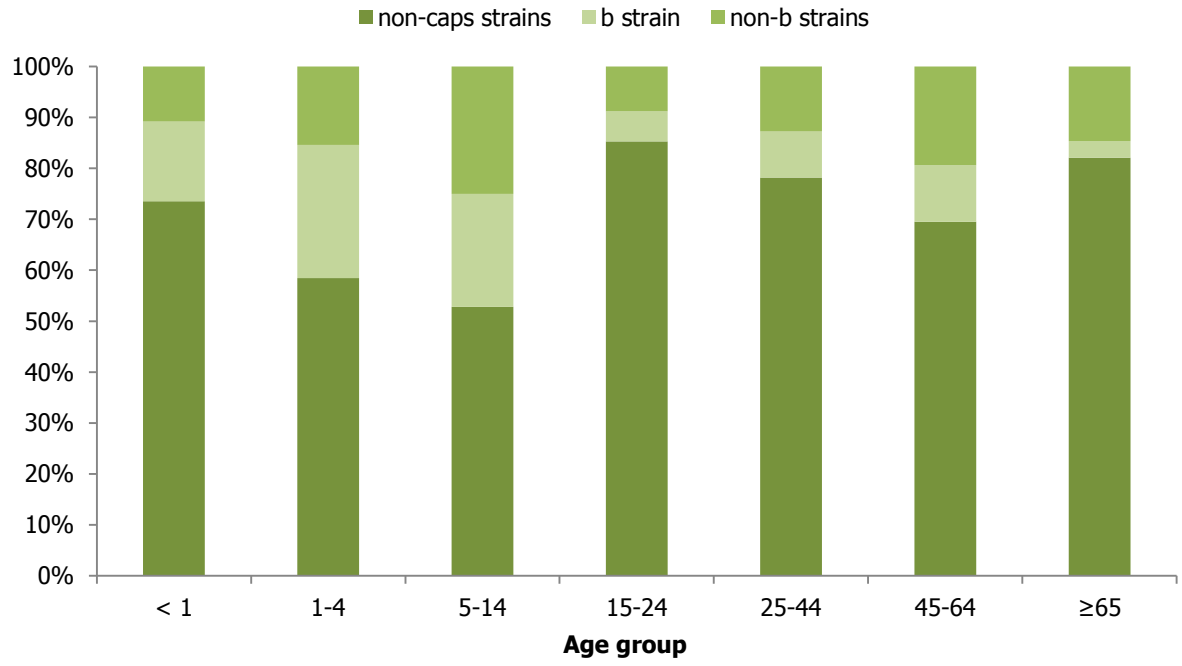


Figure 5. Rates of confirmed invasive *Haemophilus influenzae* disease reported cases by age and serotype, EU/EEA, 2012 (n=1 348)



Source: Country reports.

Discussion

In EU/EEA countries, cases of invasive *Haemophilus influenzae* disease are rare. In general, notifications rates are low and relatively stable. As in previous years, the disease was most common in the north of Europe and in the United Kingdom. This observation is possibly due to improved case ascertainment, the implementation of enhanced surveillance systems and an increased awareness among clinicians.

Serotype b infections have remained constantly low, with a slightly decreasing trend, highlighting the success of the Hib vaccine [3]. 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. In the past, surveillance systems in many countries only recorded Hib cases in the age group of 0–5 years.

However, over the last few years, most countries have enhanced their surveillance systems and now cover all age groups and non-b/non-typeable serotypes. In addition, as the disease is rare and the reported number of cases is relatively low, small changes in numbers may cause large differences in notification rates and proportions.

At the European level, the completeness of serotype data has been improving in recent years. Robust serotype data is essential to accurately assessing changes in serotype distribution. From the literature, different results have been reported in recent studies conducted in different countries. Although potential serotype replacement has been reported in some studies [4,5], the majority have found no concrete evidence to support this [6-9].

Children under one year of age continue to represent the highest burden. Increase in the use of blood cultures in some countries might have contributed to the identification of more cases with pneumonia and bacteraemia [4]. Indeed, non typeable *H. influenzae* is a common cause of community acquired bacterial pneumonia in adults [10].

It is important that Hib immunisation coverage rates are maintained and possibly increased, since the vaccine has proven to be effective. Continued monitoring of strains, together with the clinical syndromes to which they are associated, is essential for assessing the effect of interventions.

Surveillance systems overview

Country	Data Source	Compulsory (Cp) / Voluntary (V) / Other(O)	Comprehensive (Co) / Sentinel (Se) / Other(O)	Active (A) / Passive (P)	Case-Based (C)/Aggregated (A)	Data reported by				National coverage	Case definition used
						Laboratories	Physicians	Hospitals	Others		
Austria	AT-Epidemiegesetz	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2008
Belgium	BE-LABNET	V	Se	A	C	Y	N	-	-	Y	Not specified/unknown
Bulgaria	BG-NATIONAL_SURVEILLANCE	Cp	Co	P	A	Y	Y	Y	Y	Y	EU-2008
Cyprus	CY-NOTIFIED_DISEASES	Cp	Co	P	C	N	Y	N	N	Y	EU-2008
Czech Republic	CZ-EPIDAT	Cp	Co	A	C	N	Y	Y	N	Y	EU-2008
Denmark	DK-LAB	Cp	Co	P	C	Y	N	N	N	Y	Not specified/unknown
Estonia	EE-HIB	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2008
Finland	FI-NIDR	Cp	Co	P	C	Y	N	N	N	Y	Not specified/unknown
France	FR-EPIBAC	V	Se	A	C	Y	N	Y	N	Y	EU-2008
Germany	DE-SURVNET@RKI-7.1/6	Cp	Co	P	C	Y	Y	Y	Y	Y	Other
Greece	GR-NOTIFIABLE_DISEASES	Cp	Co	P	C	Y	Y	Y	N	Y	Other
Hungary	HU-EFRIR	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Ireland	IE-CIDR	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Italy	IT-MENINGITIS	Cp	Co	P	C	N	Y	Y	Y	-	EU-2008
Latvia	LV-BSN	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2012
Lithuania	LT-COMMUNICABLE_DISEASES	Cp	Co	P	C	Y	Y	N	N	Y	EU-2008
Malta	MT-DISEASE_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2008
Netherlands	NL-NRBM	V	Co	P	C	Y	N	N	N	Y	EU-2008
Norway	NO-MSIS_A	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2012
Poland	PL-NATIONAL_SURVEILLANCE	Cp	Co	P	C	N	Y	Y	N	Y	Not specified/unknown
Portugal	PT-HAEMOPHILUS_INFLUENZAE	Cp	Co	P	C	Y	Y	N	N	Y	EU-2008
Romania	RO-RNSSy	Cp	Co	P	C	N	N	Y	N	Y	EU-2008
Slovakia	SK-EPIS	Cp	Co	A	C	Y	Y	Y	N	Y	EU-2012
Slovenia	SI-SURVIVAL	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Spain	ES-MICROBIOLOGICAL	V	Se	P	C	Y	N	N	N	N	EU-2008
Sweden	SE-SMINET	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2012
United Kingdom	UK-HIB	O	Co	P	C	Y	N	Y	Y	Y	EU-2002

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Invasive meningococcal disease

- Invasive meningococcal disease (IMD) is rare in Europe: 0.68 cases per 100 000 population in 2012 and country-specific rates of confirmed IMD ranging from 0.11 to 1.77 cases per 100 000 population.
- Infants younger than one year of age are at the highest risk of infection, followed by 15–24 year olds.
- Most cases of invasive meningococcal disease are caused by serogroups B and C, with serogroup B being dominant. Disease caused by serogroup Y has been increasing although it is still less frequent than B and C.
- Although IMD is a rare disease, case fatality is about 10%, with many survivors suffering serious long-term sequelae.
- An overall decreasing trend has been observed over the last ten years, partly attributable to the introduction of serogroup C conjugate vaccine to national immunisation schedules in some countries.
- It is important to strengthen surveillance of meningococcal disease to evaluate the impact of the ongoing vaccination programmes and support decision-makers, particularly in view of the recent availability of new vaccines.

Invasive meningococcal disease (IMD) is an acute bacterial disease that is uncommon, but often severe and potentially life-threatening. The infectious agent is *Neisseria meningitidis,* a Gram-negative aerobic diplococcus. Invasive disease is characterised by meningitis, bacteraemia, sepsis, or, less commonly, pneumonia, arthritis, and pericarditis. Case-fatality rates are high, at approximately 8–15%. Ten to 20% of survivors suffer long-term sequelae, including mental retardation, hearing loss, and loss of limb use [1].

N. meningitidis is divided into serogroups according to the immunological reactivity of its capsular polysaccharide. Vaccines are available to protect against meningococcal infection due to serogroup C, serogroup B (vaccine licensed in 2013 for use from the age of two months) or serogroups A, C, W and Y (quadrivalent vaccine licensed in 2010, for use from the age of 12 months).

Since several countries have introduced the serogroup C conjugate vaccine to routine childhood immunisation, a decrease in the disease burden has been observed. As of January 2014, no countries have included the serogroup B vaccine in their childhood immunisation programmes [2], although it has been recommended for inclusion in the United Kingdom [3].

Epidemiological situation in 2012

In 2012, 3 467 confirmed cases of IMD were reported by 28 EU/EEA countries. Overall, the notification rate in EU/EEA countries decreased from 0.95 cases per 100 000 population in 2008 to 0.68 cases per 100 000 in 2012. Lithuania, the United Kingdom and Ireland reported the highest rates in 2012 with 1.77, 1.36 and 1.31 confirmed cases per 100 000 population (Table 2). Twenty-six of the 28 countries have surveillance systems with national coverage. Belgium and Cyprus conduct voluntary sentinel surveillance. In 2012, for the first time the Danish data were reported from a nationwide laboratory surveillance system, which was recently established [4]. Iceland did not report data in 2012.

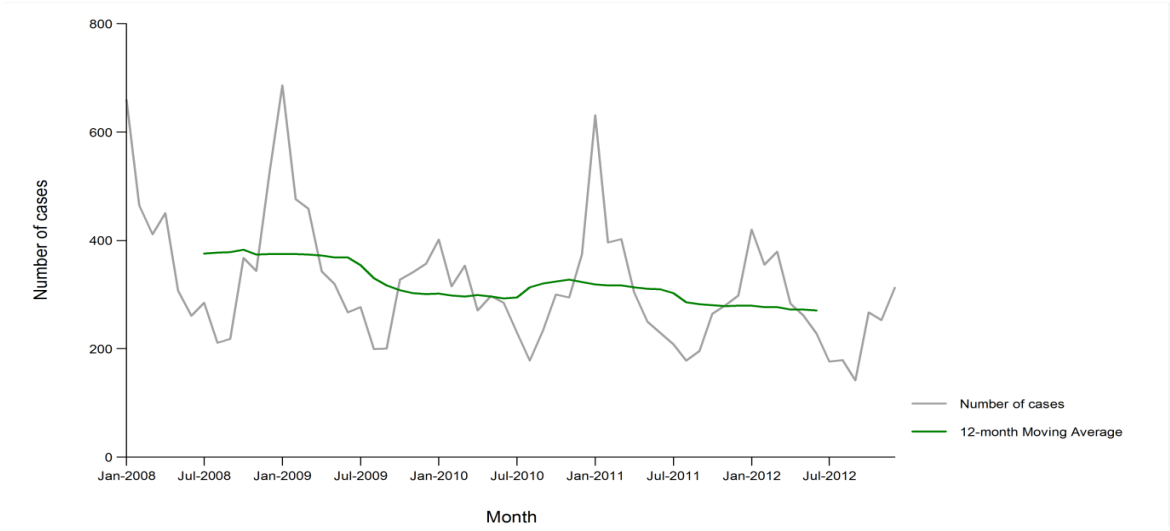
Table 2. Numbers and rates of confirmed invasive meningococcal disease reported cases, EU/EEA, 2008-12

Country	2012					2011		2010		2009		2008	
	National data	Report type	Cases	Rate	ASR	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Austria	Y	C	56	0.67	0.71	50	0.60	85	1.02	89	1.07	84	1.01
Belgium	N	C	115	-	-	111	-	96	-	104	-	111	-
Bulgaria	Y	A	8	0.11	0.12	13	0.18	8	0.11	16	0.21	20	0.27
Cyprus	N	C	6	-	-	1	-	1	0.12	1	0.13	2	0.26
Czech Republic	Y	C	59	0.56	0.56	63	0.60	60	0.57	80	0.77	82	0.79
Denmark	Y	C	56	1.00	0.95	72	1.30	66	1.19	71	1.29	64	1.17
Estonia	Y	C	6	0.45	0.44	7	0.53	2	0.15	5	0.37	6	0.45
Finland	Y	C	33	0.61	0.59	34	0.63	34	0.64	33	0.62	28	0.53
France	Y	C	550	0.84	0.81	563	0.87	511	0.79	606	0.94	657	1.03
Germany	Y	C	354	0.43	0.48	370	0.45	384	0.47	493	0.60	452	0.55
Greece	Y	C	59	0.53	0.58	52	0.47	55	0.49	77	0.69	78	0.70
Hungary	Y	C	51	0.52	0.54	67	0.68	37	0.38	37	0.38	30	0.30
Ireland	Y	C	60	1.31	1.04	89	1.95	98	2.15	134	2.96	152	3.41
Italy	Y	C	136	0.23	0.25	152	0.26	150	0.25	181	0.31	179	0.31
Latvia	Y	C	4	0.20	0.21	2	0.10	5	0.24	4	0.19	7	0.32
Lithuania	Y	C	53	1.77	1.81	42	1.38	48	1.53	39	1.23	48	1.49
Luxembourg	Y	C	3	0.57	0.36	2	0.39	1	0.20	3	0.61	2	0.41
Malta	Y	C	4	0.96	0.90	6	1.45	2	0.48	5	1.22	3	0.74
Netherlands	Y	C	109	0.65	0.64	106	0.64	143	0.86	152	0.92	162	0.99
Poland	Y	C	239	0.62	0.61	282	0.73	228	0.60	302	0.79	338	0.89
Portugal	Y	C	69	0.66	0.71	77	0.74	80	0.77	65	0.63	61	0.59
Romania	Y	C	71	0.35	0.36	68	0.34	52	0.26	102	0.51	104	0.51
Slovakia	Y	C	31	0.57	0.56	21	0.39	37	0.69	39	0.73	48	0.89
Slovenia	Y	C	9	0.44	0.46	13	0.63	9	0.44	15	0.74	24	1.19
Spain	Y	C	335	0.72	0.72	435	0.93	404	0.87	533	1.15	590	1.29
Sweden	Y	C	103	1.09	1.04	68	0.72	67	0.72	65	0.70	49	0.53
United Kingdom	Y	C	864	1.36	1.23	1036	1.66	1008	1.62	1194	1.94	1356	2.22
EU Total	**-**	**-**	**3443**	**0.68**	**0.68**	**3802**	**0.76**	**3671**	**0.73**	**4445**	**0.89**	**4737**	**0.96**
Iceland	-	-	-	-	-	2	0.63	2	0.63	5	1.57	2	0.63
Liechtenstein	-	-	-	-	-	-	-	-	-	-	-	-	-
Norway	Y	C	24	0.48	0.47	37	0.75	39	0.80	44	0.92	36	0.76
EU/EEA Total	**-**	**-**	**3467**	**0.68**	**0.68**	**3841**	**0.76**	**3712**	**0.74**	**4494**	**0.89**	**4775**	**0.95**

ASR: Age standardised rate

Source: Country reports; Y: Yes; N: No; A: Aggregated data report; C: Case-based data report; –: No report; U: Unspecified.

Figure 6. Distribution of confirmed invasive meningococcal disease reported cases, EU/EEA, 2008–12

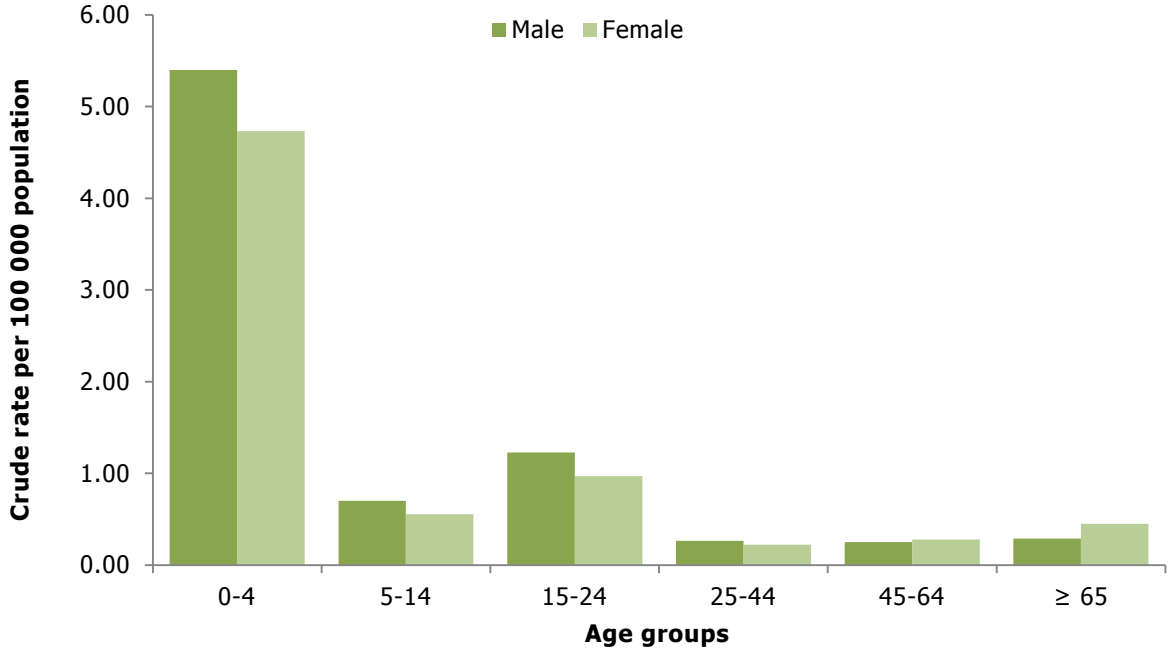


Source: Country reports from Austria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Age and gender distribution

Children under five years continued to experience the highest rates of IMD (5.10 per 100 000, both genders), followed by those aged 15–24 years (1.11 per 100 000, both genders). The rates were similar when stratified by gender, with a slight preponderance of males in most age groups and especially in children under five years (Figure 7).

Figure 7. Rates of confirmed invasive meningococcal disease reported cases by age and gender, EU/EEA, 2012

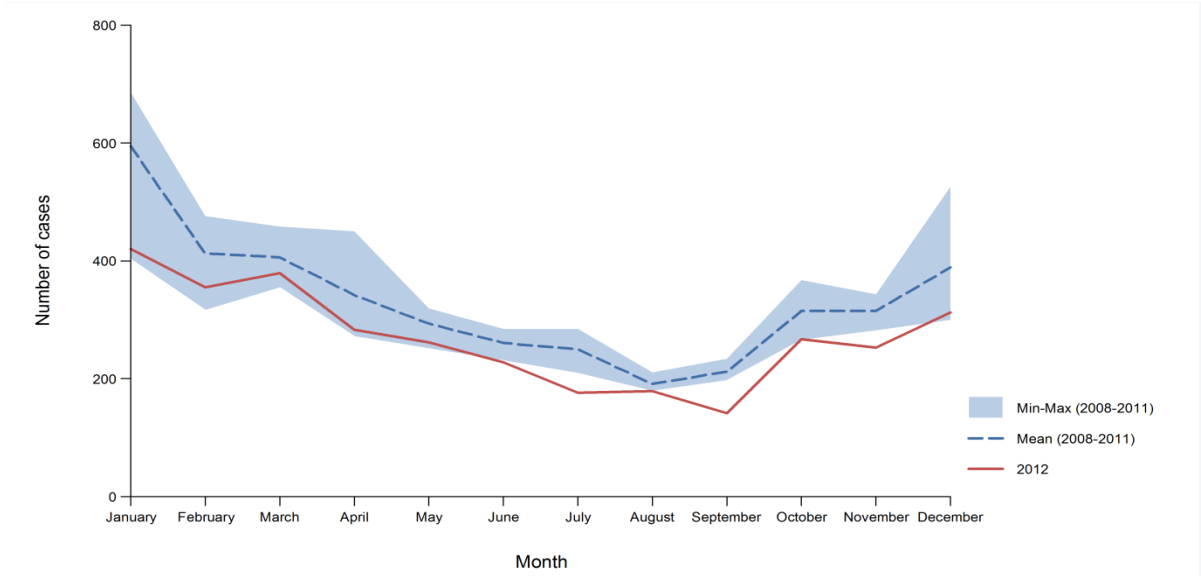


Source: Country reports from Austria, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Seasonality

In 2012, as in previous years, a seasonal pattern was observed. IMD occurred primarily in winter and declined by late summer. This picture is compatible with the known epidemiology of meningococcal disease. The monthly distribution of cases from 2008 to 2012 is presented in Figure 8.

Figure 8. Seasonal distribution of confirmed invasive meningococcal disease reported cases, EU/EEA, 2008–2012



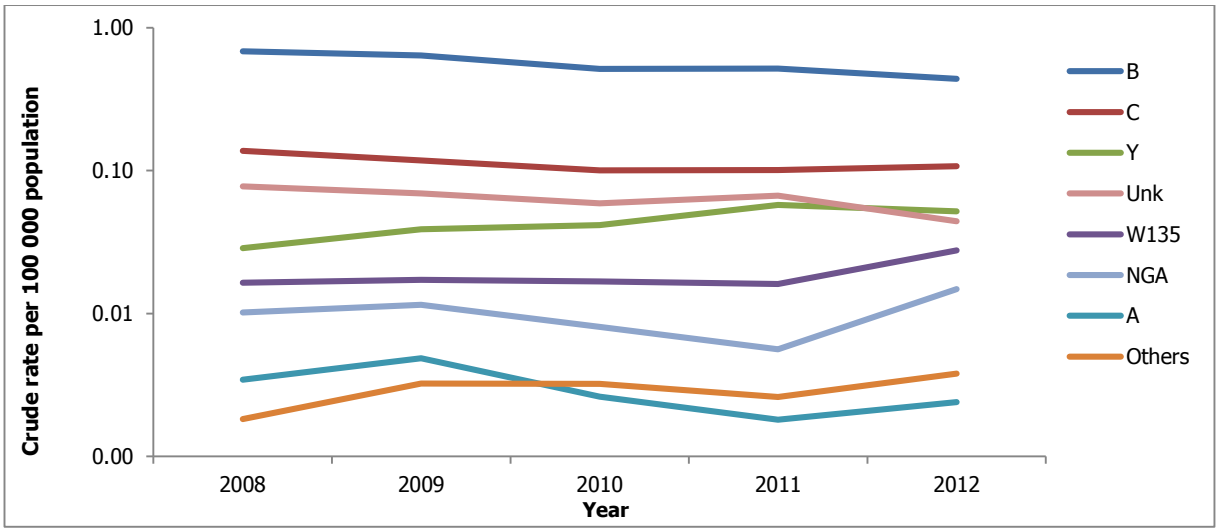
Source: Country reports from Austria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Enhanced surveillance in 2012

The incidence of invasive meningococcal disease continues to decline, largely due to the decreasing incidence of serogroup B disease. An increase in the notification rates has been observed for serogroup Y in recent years, although a lower rate was observed in 2012 than in 2011 (Figure 9). The highest proportion of cases in all age groups – particularly among children below five years – was due to serogroup B, followed by serogroup C (Figure 10). The highest proportion of serogroup C cases was observed in 25–44 year olds. The highest proportion of serogroup Y cases was observed in those aged ≥65 years.

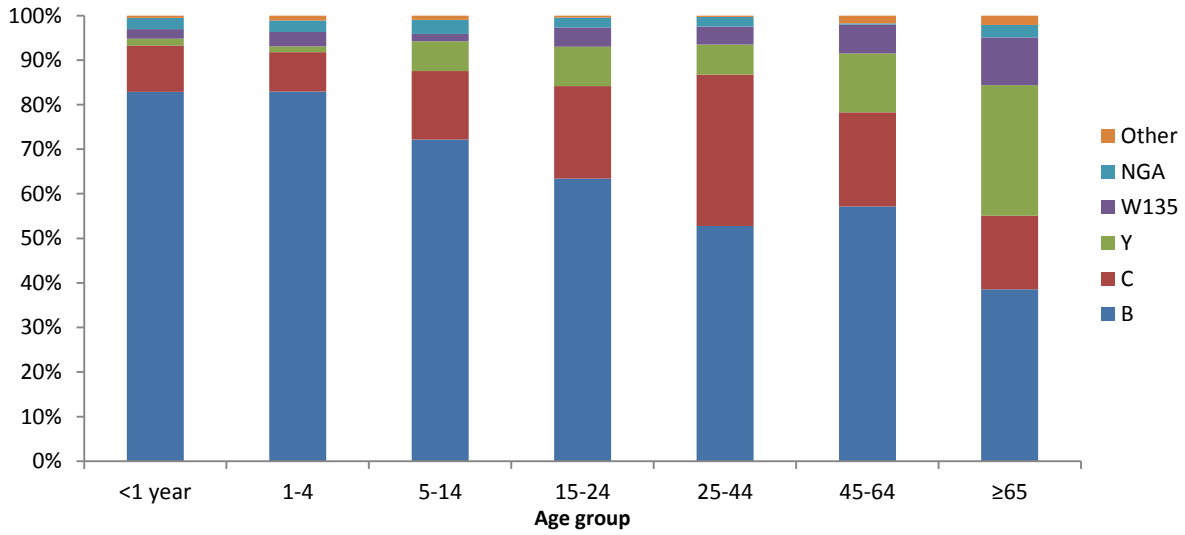
The notification rate in children below one year of age was three times higher than the rate in those between one and four years of age (12.3 and 4.1 cases per 100 000, all serogroups). Infants, children between one and four years of age and adolescents between 15 and 24 years of age are the most affected in countries with and without vaccination programmes against serogroup C IMD. However, a decline in serogroup C has been observed in countries that have implemented programmes in the respective age groups (Figures 11 and 12). In countries where meningococcal serogroup C vaccination was introduced into routine schedules after 2008, there has been a notable decrease in the rate of invasive meningococcal infection in recent years (Figure 12).

Figure 9. Rates of confirmed invasive meningococcal disease reported cases by serogroup, EU/EEA, 2008-2012 (n=20 161)



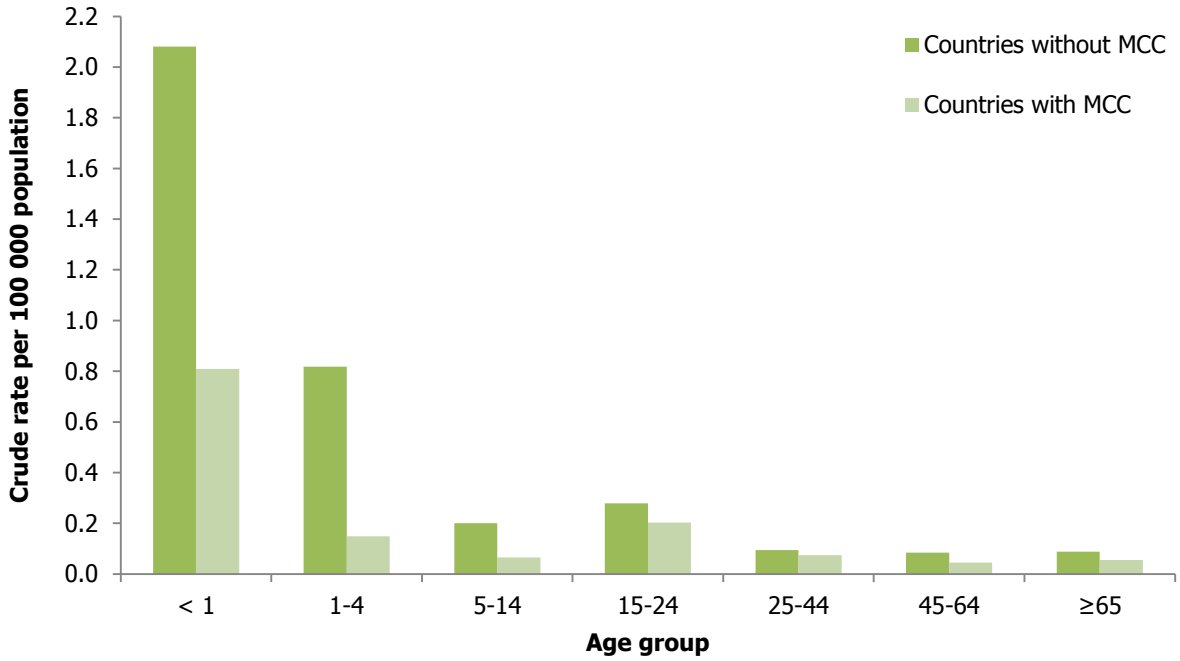
Source: Country reports; NGA: non-groupable; Unk: unknown. The specific codes are kept for the most common serogroups. Others are the remaining/other groupable serogroups that should be reported. Apart from serogroups reported as 'other' (n=42), it includes cases of serogroups 29E (13), X (n=13) and Z (n=5) reported during the period 2008–2012.

Figure 10. Rates of confirmed invasive meningococcal disease reported cases by age and serogroup, EU/EEA, 2012 (n=3 233)



Source: Country reports; NGA: non-groupable.; 'Other' includes confirmed cases reported as serogroup 'other' (n=15), as serogroup A (n=12), serogroup 29E (n=3) and serogroup Z (n=1). The specific codes are kept for the most common serogroups. Others are the remaining/other groupable serogroups that should be reported.

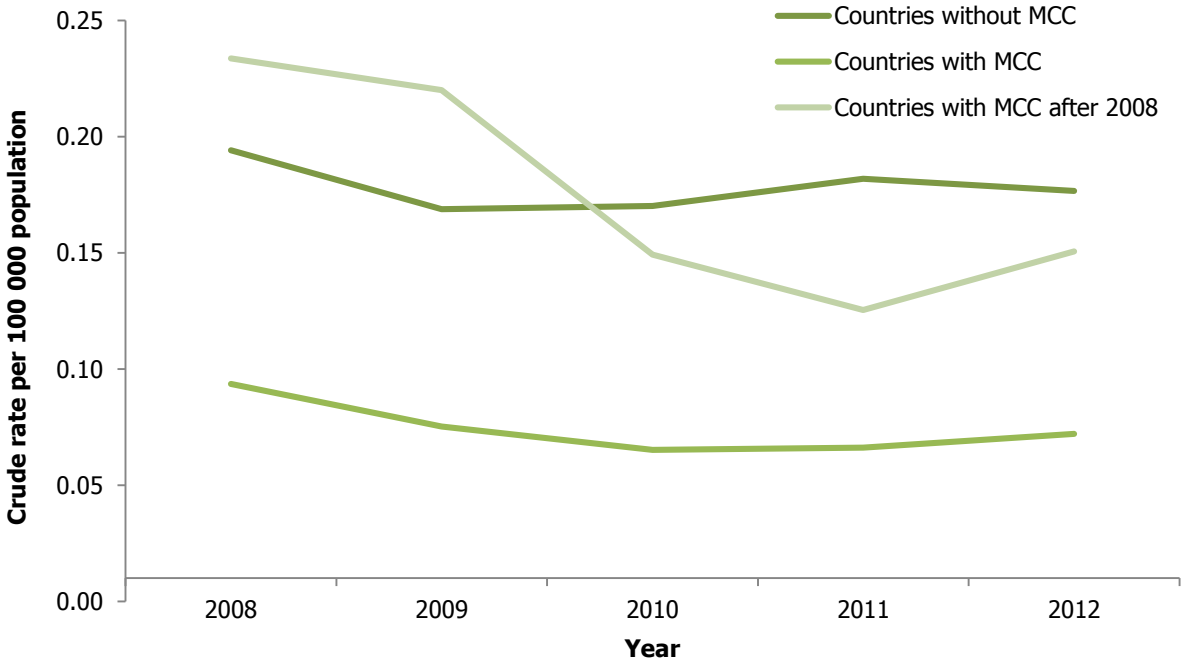
Figure 11. Rates of serogroup C invasive meningococcal disease reported cases, by age group and availability of meningococcal C conjugate (MCC) vaccination in their routine immunisation schedule, EU/EEA, 2012 (n=536)



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

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

Figure 12. Rates of serogroup C invasive meningococcal disease reported cases by vaccination policy, EU/EEA, 2008-2012 (n=2 792)



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

Contributing countries with MCC:
- before 2008: Belgium, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain and the United Kingdom.
- after 2008: Austria, France.

Discussion

IMD is rare in Europe where 0.68 cases per 100 000 population were observed in 2012. Notification rates of confirmed cases in Europe range from 0.11 to 1.77 cases per 100 000 population. The majority of cases were attributed to serogroups B and C, with serogroup B being dominant.

The reduction in the proportion of meningococcal infection due to serogroup C is mainly attributable to the introduction of universal vaccination programmes in some EU/EEA countries [5-8].

Children under one year remain the most affected age group; however, carriage rates are highest in adolescents and young adults [9]. Therefore, high levels of immunity in this age group are critical to ensure the protection of other vulnerable age groups [10].

The surveillance systems used for reporting data to ECDC are heterogeneous; some are based on clinical syndromes and some are based on laboratory results only [8]. Therefore, variations in reported rates between countries may reflect differences in surveillance systems, case ascertainment and methods for confirming cases.

Continued strengthening of IMD surveillance is important to evaluate the impact of ongoing vaccination programmes and to support decision-makers in view of the availability of new vaccines such as the one against serogroup B.

Surveillance at European level will become even more important as the incidence of disease declines. The pooling of data may enable the description of trends which are difficult to discern at national level. In addition to routine surveillance, sharing information among European countries in real-time may help increase knowledge of the disease or support other scientific findings and stimulate control measures. A recent example in 2013, when a cluster of seven cases (serogroup C), occurred in the high-risk group of men who have sex with men and was reported by three different countries via EPIS-VPD, stresses the added value of international collaboration [11].

Quite a few possibilities now exist for prevention of meningococcal disease: vaccines targeting one serogroup (C or B), or four (A, C, W135, Y); polysaccharide vaccines (immunogenic after the age of two years) or conjugated vaccines (immunogenic after the age of 2 months). The choice of introducing the vaccination into the routine programme depends on national recommendations which take into account the specific epidemiological picture of the disease in the country. Ad hoc offering of vaccination may be considered when responding to clusters or outbreaks of meningococcal disease.

Surveillance systems overview

Country	Data source	Compulsory (Cp) / Voluntary (V) /Other(O)	Comprehensive (Co) / Sentinel (Se)/Other(O)	Active (A) / Passive (P)	Case-Based (C)/Aggregated (A)	Data reported by				National coverage	Case definition used
						Laboratories	Physicians	Hospitals	Others		
Austria	AT-Epidemiegesetz	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2008
Belgium	BE-REFLAB	V	Se	A	C	Y	N	N	N	Y	Not specified/unknown
Bulgaria	BG-NATIONAL_SURVEILLANCE	Cp	Co	P	A	Y	Y	Y	Y	Y	EU-2008
Cyprus	CY-LABNET	V	Se	A	C	Y	N	N	N	N	Not specified/unknown
Czech Republic	CZ-EPIDAT	Cp	Co	A	C	N	Y	Y	N	Y	EU-2008
Denmark	DK-LAB	V	Co	P	C	Y	N	N	N	Y	Not specified/unknown
Estonia	EE-MENINGOCOCC	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2008
Finland	FI-NIDR	Cp	Co	P	C	Y	Y	N	N	Y	Other
France	FR-MANDATORY_INFECTIOUS_DISEASES	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2008
Germany	DE-SURVNET@RKI-7.1/6	Cp	Co	P	C	Y	Y	Y	Y	Y	Other
Greece	GR-NOTIFIABLE_DISEASES	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Hungary	HU-EFRIR	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Ireland	IE-CIDR	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Italy	IT-MENINGITIS	Cp	Co	P	C	N	Y	Y	N	Y	EU-2008
Latvia	LV-BSN	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2012
Lithuania	LT-COMMUNICABLE_DISEASES	Cp	Co	P	C	Y	Y	N	N	Y	EU-2008
Luxembourg	LU-SYSTEM1	Cp	Co	P	C	N	Y	N	N	Y	EU-2002
Malta	MT-DISEASE_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2008
Netherlands	NL-OSIRIS	Cp	Co	P	C	Y	Y	N	N	Y	EU-2008
Norway	NO-MSIS_A	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2012
Poland	PL-NATIONAL_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Portugal	PT-MENINGOCOCAL	Cp	Co	P	C	Y	Y	N	N	Y	EU-2008
Romania	RO-RNSSy	Cp	Co	P	C	N	N	Y	N	Y	EU-2008
Slovakia	SK-EPIS	Cp	Co	A	C	Y	Y	Y	N	Y	EU-2012
Slovenia	SI-SURVIVAL	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Spain	ES-STATUTORY_DISEASES	Cp	Co	P	C	N	Y	Y	N	Y	EU-2008
Sweden	SE-SMINET	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2012
United Kingdom	UK-MENINGOCOCCAL	O	Co	P	C	Y	N	Y	Y	Y	EU-2012

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Invasive pneumococcal disease

- The overall confirmed notification rate of invasive pneumococcal disease remained stable at 4.28 cases per 100 000 population in 2012.
- Country-specific rates were highest in the Nordic countries; age-specific rates were highest in young children and adults over 65 years.
- The emergence of non-vaccine serotypes remains an important issue to be monitored; continued monitoring in Europe is essential for assessing interventions and informing the development of new vaccines.

Invasive pneumococcal disease (IPD) is an acute and life-threatening disease caused by *Streptococcus pneumoniae.* Invasive disease encompasses severe syndromes including meningitis, pneumonia/empyema, bacteraemia and sepsis. Non-invasive disease includes otitis media and upper respiratory tract infections. More than 90 serotypes have been identified; however only a limited number cause invasive disease. Globally, an estimated 1.6 million people die of IPD annually, including one million children under five years of age [1].

Vaccines are available to protect against pneumococcal infection: a polysaccharide vaccine including 23 serotypes is licensed for adults and children over two years (PPV23); three conjugate vaccines are licensed and immunogenic for infants and include 7, 10 or 13 serotypes (PCV7, PCV10 and PCV13). In most European countries PCV10, PCV13 and PPV23 are the vaccines used in the national programmes [2].

Epidemiological situation in 2012

In 2012, 20 785 confirmed cases of IPD were reported by 27 countries, 22 of which run surveillance systems with national coverage. Belgium, Cyprus, France, the Netherlands and Spain reported data from sentinel surveillance and were excluded from the notification rates analysis. In 2012 for the first time, the Danish data were reported from a nationwide laboratory surveillance system, which was recently established [3]. In addition, for the first time the Dutch data presented for all years are from a sentinel laboratory surveillance covering all age categories, whereas previous reports used the national notification system which only included cases up to five years of age. The sentinel system is known to include almost all cases in the catchment area, as compared to the national system which does not have good coverage.

The overall reported confirmed case rate was 4.28 per 100 000, comparable with the previous two years (Table 3, Figure 13). Higher notification rates were observed in Nordic countries than in other countries, with the highest rates reported by Denmark (15.81 per 100 000), Sweden (14.63), Finland (13.92) and Norway (12.56). Luxembourg reported the lowest confirmed case rate, 0.19 per 100 000, followed by Lithuania (0.23), Bulgaria (0.26), Greece (0.39) and Romania (0.39).

The total number of reported confirmed cases has significantly increased since 2009 (14 483), which is largely a consequence of improvements in reporting in some countries (Denmark, Spain), the inclusion of data from a different data source (Czech Republic, the Netherlands, Denmark), the first contributions by Iceland and France, and the inclusion of invasive pneumococcal disease as mandatorily reportable (Latvia, 2010). If these seven countries are excluded, the overall EU trend was stable during the period 2008–2012.

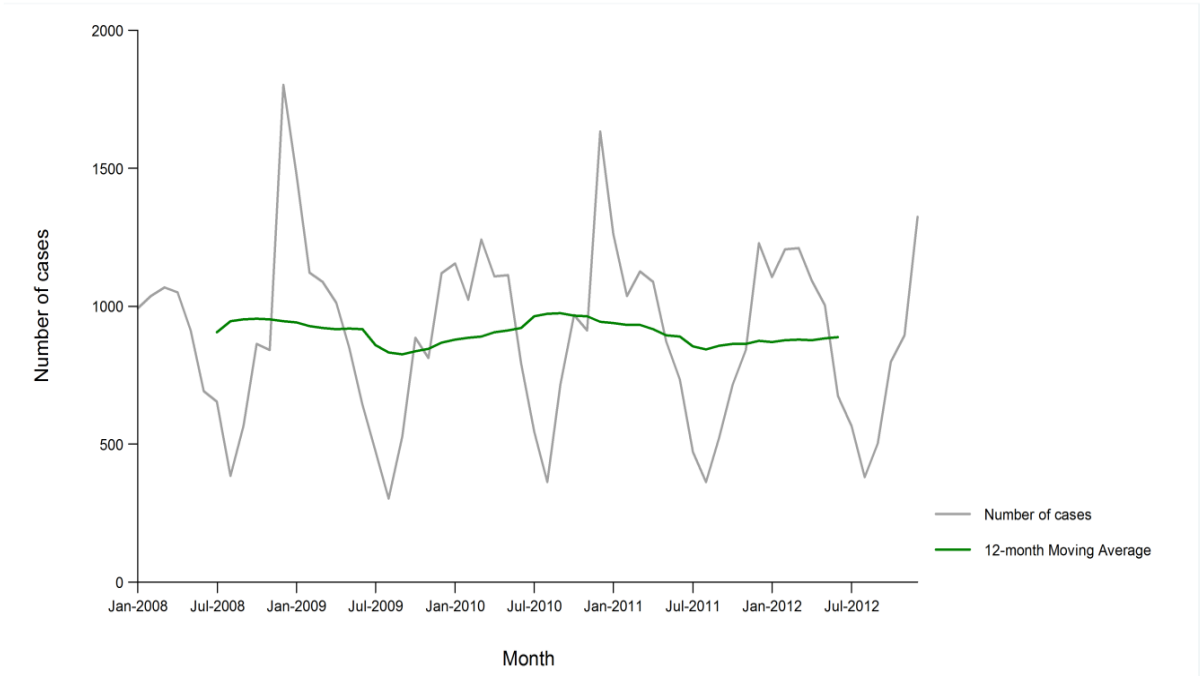
Table 3. Numbers and rates of confirmed invasive pneumococcal disease reported cases, EU/EEA, 2008–2012

Country	2012					2011		2010		2009		2008	
	National data	Report type	Cases	Rate	ASR	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Austria	Y	C	235	2.80	2.68	158	1.88	325	3.88	296	3.54	133	1.60
Belgium	N	C	1738	-	-	1836	-	1851	-	2051	-	1875	-
Bulgaria	Y	A	19	0.26	0.26	37	0.50	26	0.35	46	0.62	35	0.47
Cyprus	N	C	10	-	-	12	-	11	-	9	1.13	21	2.71
Czech Republic	Y	C	335	3.19	3.17	384	3.66	300	2.87	143	1.37	117	1.13
Denmark	Y	C	882	15.81	15.30	924	16.62	960	17.35	129	2.34	120	2.19
Estonia	Y	C	20	1.51	1.43	18	1.35	14	1.05	14	1.05	32	2.39
Finland	Y	C	752	13.92	13.18	779	14.49	834	15.59	855	16.05	926	17.47
France	N	C	4430	-	-	5037	-	5117	-	-	-	-	-
Germany	-	-	-	-	-	-	-	-	-	-	-	-	-
Greece	Y	C	43	0.39	0.37	41	0.37	38	0.34	66	0.59	63	0.56
Hungary	Y	C	186	1.88	1.85	107	1.09	108	1.10	49	0.50	65	0.66
Ireland	Y	C	350	7.64	8.92	357	7.81	304	6.68	357	7.90	401	9.00
Italy	Y	C	787	1.33	1.19	713	1.20	854	1.44	738	1.25	694	1.18
Latvia	Y	C	56	2.74	2.63	51	2.46	16	0.76	7	0.32	7	0.32
Lithuania	Y	C	7	0.23	0.24	9	0.30	9	0.29	16	0.50	18	0.56
Luxembourg	Y	C	1	0.19	0.23	2	0.39	2	0.40	0	0.00	0	0.00
Malta	Y	C	15	3.59	2.88	11	2.65	11	2.66	9	2.19	0	0.00
Netherlands	N	C	635	-	-	622	-	571	-	605	-	609	-
Poland	Y	C	402	1.04	1.08	351	0.91	333	0.87	274	0.72	212	0.56
Portugal	-	-	-	-	-	-	-	-	-	-	-	-	-
Romania	Y	C	79	0.39	0.39	90	0.45	80	0.40	122	0.60	0	0.00
Slovakia	Y	C	49	0.91	0.94	57	1.06	18	0.33	29	0.54	36	0.67
Slovenia	Y	C	245	11.92	11.55	255	12.44	224	10.94	253	12.45	204	10.15
Spain	N	C	2260	-	-	2220	-	2212	-	1339	-	1648	-
Sweden	Y	C	1387	14.63	13.76	1361	14.46	1456	15.59	1618	17.48	1789	19.48
United Kingdom	Y	C	5209	8.20	8.12	4632	7.41	5616	9.05	5019	8.14	5514	9.02
EU Total	**-**	**-**	**20132**	**4.12**	**3.99**	**20064**	**3.87**	**21290**	**4.33**	**14044**	**3.77**	**14519**	**3.91**
Iceland	Y	C	27	8.45	9.37	33	10.36	32	10.08	-	-	-	-
Liechtenstein	-	-	-	-	-	-	-	-	-	-	-	-	-
Norway	Y	C	626	12.56	13.09	729	14.82	748	15.40	799	16.65	855	18.05
EU/EEA Total	**-**	**-**	**20785**	**4.28**	**4.15**	**20826**	**4.07**	**22070**	**4.53**	**14843**	**4.00**	**15374**	**4.16**

ASR: Age standardised rate

Source: Country reports; Y: Yes; N: No; A: Aggregated data report; C: Case-based data report; –: No report.

Figure 13. Distribution of confirmed invasive pneumococcal disease reported cases, EU/EEA, 2008-2012

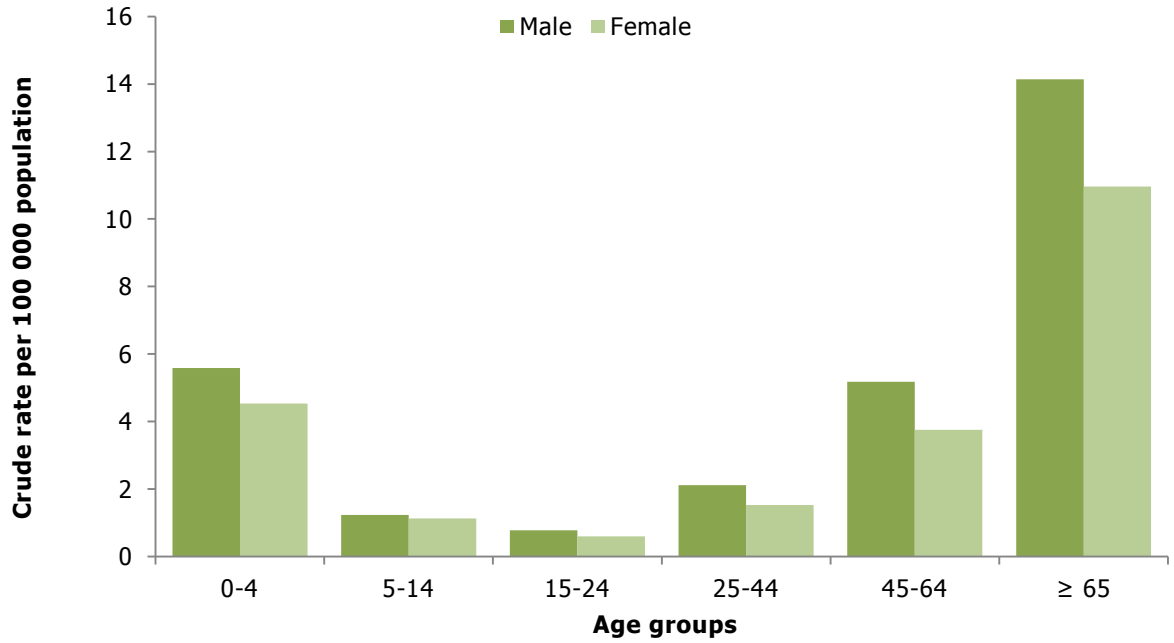


Source: Country reports from Austria, Bulgaria, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Italy, Luxembourg, Malta, Norway, Romania, Slovakia, Slovenia, Sweden and United Kingdom.

Age and gender distribution

IPD is predominantly found in adults aged 65 or over (followed by young children under five years and adults aged between 45 and 64 years) (Figure 14). The notification rate of confirmed cases was 5.06 per 100 000 population in children under five (10.86 in children aged under one year, data not shown) and 12.12 per 100 000 population in adults aged 65 years or older. Across age groups, rates in males were higher than in females, giving an overall male-to-female ratio of 1.2:1.

Figure 14. Rates of confirmed invasive pneumococcal disease reported cases by age and gender, EU/EEA, 2012

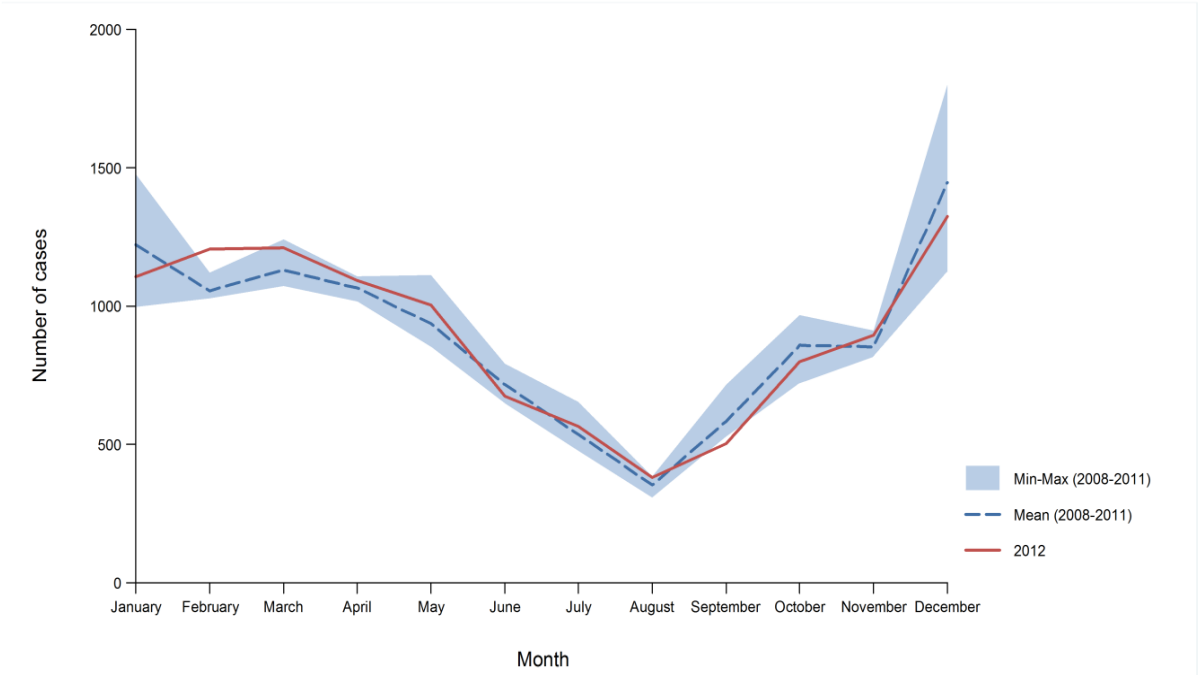


Source: Country reports from Austria, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, Poland, Romania, Slovakia, Slovenia, Sweden and United Kingdom.

Seasonality

The seasonal distribution of IPD cases follows a pattern similar to that of other respiratory diseases. In 2012, the lowest rates were observed during summer, increasing rapidly with the onset of autumn and winter and peaking in December. This pattern was similar to that for the period 2008–2011 (Figure 15).

Figure 15. Seasonal distribution of confirmed invasive pneumococcal disease reported cases, EU/EEA, 2008-2012



Source: Country reports from Austria, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, Poland, Romania, Slovakia, Slovenia, Sweden and United Kingdom.

Enhanced surveillance in 2012

Enhanced surveillance for IPD has been ongoing at ECDC since 2010. In 2012, 23 EU/EEA countries reported data on serotype (13 837 isolates, 67% of all confirmed cases); this represents a slightly lower level of completeness as compared to 2011.

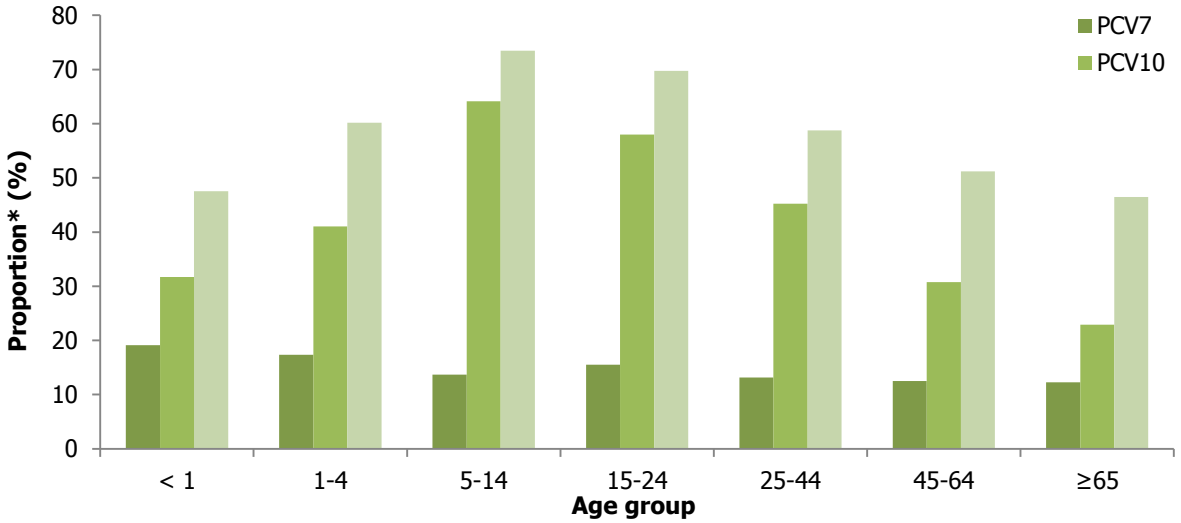
Among all age groups, the 10 most common serotypes were 3, 7F, 19A, 1, 22F, 8, 14, 12F, 6C and 15A (ordered by frequency), accounting for 59.2% of the typed isolates. This is almost identical to the 10 most common serotypes observed in 2011, with a difference of only one serotype between the two years (serotype 4 in 2011 and serotype 15A in 2012). The four most common serotypes (3, 7F, 19A and 1) are protected by PCV10 and/or PCV13. Two PCV7 serotypes were among the top 15, however both showed a decreasing trend between 2010 and 2012. At the same time, there was an increase in the proportion of cases caused by some non-PCV serotypes (e.g. serotypes 8, 22F, 12F, 6C and 15A) (Figure 17).

More than 50% of cases occurring in all age groups were caused by a serotype included in PCV13 and 33.6% by a serotype included in PCV10. Less than 15% of cases were caused by a PCV7 serotype (Figure 16). The serotypes observed in the majority of the reported cases aged two years and or above are included in the PPV23 vaccine.

Serotype 19A was the most common serotype in infants under one year, followed by serotype 7F. Serotypes 1 and 19A were the most common in children aged 1–4 years. Serotype 1 accounted for 37% of all serotypes isolated from cases in the 5–14 year age group. Among adults 65 years and above, the most frequent serotypes were 3 and 19A (Figure 18).

Data on antimicrobial susceptibility testing were submitted by 17 countries. The prevalence of non-susceptibility (intermediate and resistant) was highest for erythromycin (15.6%), followed by penicillin (6.9%). Very high levels of resistance to erythromycin were observed in Denmark (56.3%) and Romania (52.2%). Among all isolates tested against erythromycin, penicillin and cefotaxime/ceftriaxone, 7.3% were fully susceptible to all three and 0.15% were non-susceptible to all three. Vaccination status was reported in 18% of cases.

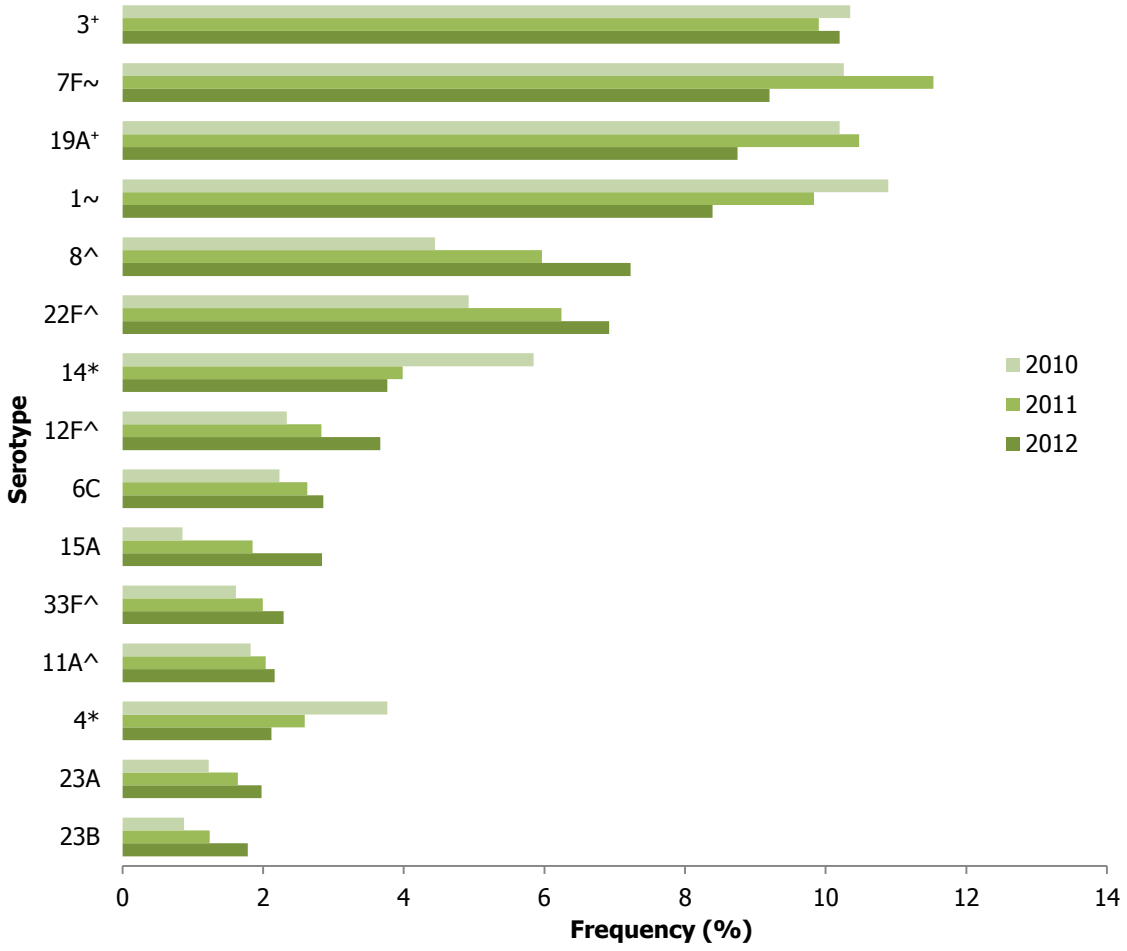
Figure 16. Proportion of confirmed invasive pneumococcal disease reported cases by age, covered by PCV serotype, EU/EEA, 2012 (n=12 992*)



Source: Country reports.

* Proportion of total cases across all age groups for which serotype and age information was available.

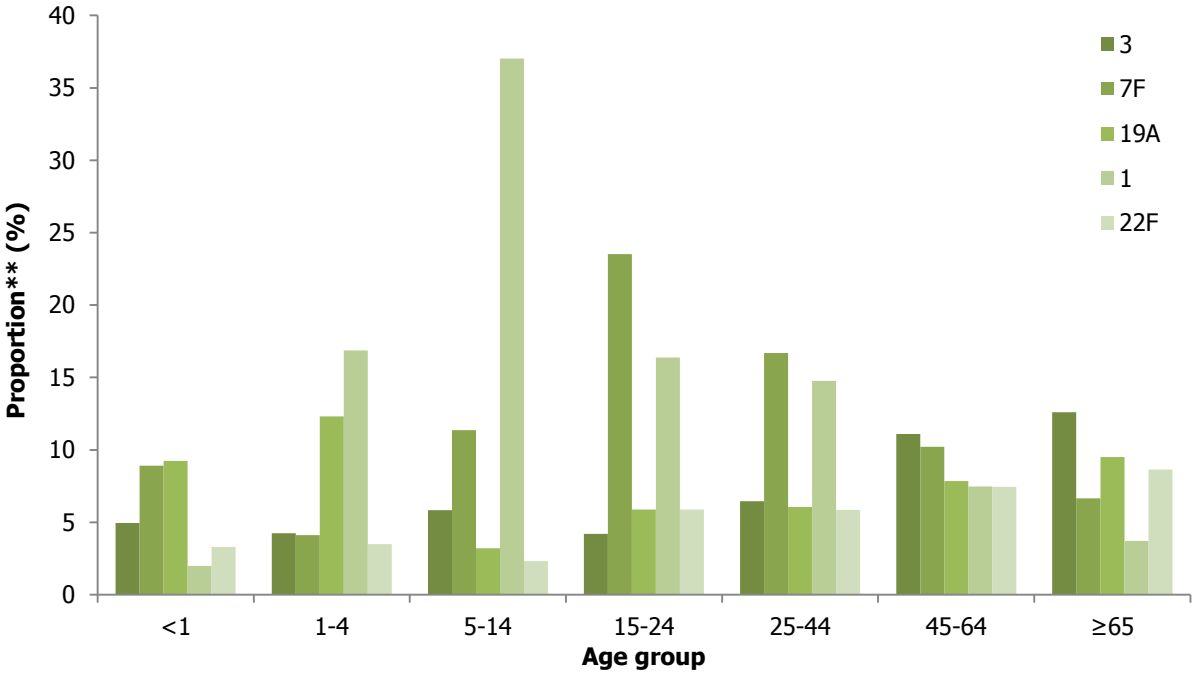
Figure 17. Distribution of confirmed invasive pneumococcal disease reported cases by 15 most common serotypes, EU/EEA, 2010–2012



Source: Country reports.

* Protected against by PCV7, PCV10, PCV13 and PPSV23
+ Protected against by PCV13 and PPSV23
~ Protected against by PCV10, PCV13 and PPSV23
^ Protected against by PPSV23 only

Figure 18. Proportion of confirmed invasive pneumococcal disease reported cases, by age and seven most frequent serotypes, EU/EEA, 2012 (n=12 992*)



Source: Country reports.

* Total number of cases for which information on serotype and age was available. It also includes 49 isolates reported as not typeable.

** Refers to the proportion of the total cases for which serotype information was available by age group: <1 year: n=303; 1–4 years: n=658; 5–14 years: n=343; 15–24 years: n=238; 25–44 years: n=1504; 45–64 years: n=3557; >=65 years: n=6389.

Discussion

The confirmed notification rate of IPD by country varied widely across Europe, ranging from 0.19 to 15.81 per 100 000 population, with the highest rates reported by Nordic countries. The overall trend was stable over the last five years, with infants under one year and the elderly (≥65 years) continuing to be the most affected age groups. Variation in inter-country incidence may be related to differences in national surveillance systems and diagnostic practices (especially regarding blood culturing) [4, 5]; for this reason, comparisons between countries should be made with caution.

Vaccination policies are also heterogeneous in Europe, both in terms of PCV for children and PPV for adults. IPD incidence in children under five years varies in countries without vaccination [6].

The introduction of pneumococcal conjugate vaccines, such as PCV7, has proved to be very effective in reducing the incidence of IPD [7]. Moreover, the vaccination of infants has resulted in 'herd immunity' by reducing nasopharyngeal carriage and transmission of the bacterium, contributing to a decrease in pneumococcal morbidity and mortality among the older age groups [8, 9]. Over time, serotype replacement has gradually reduced the effectiveness of PCV7, as the rates of carriage and disease caused by non-vaccine serotypes have increased [10]. The new conjugate vaccines, PCV10 and PCV13, covering an increased range of serotypes, have been marketed in Europe. However, it is essential to continue monitoring the relative prevalence of circulating serotypes and antimicrobial resistance in Europe in order to assess interventions and inform the development of new vaccines.

Since August 2012, ECDC funds SpID-net (*Streptococcus pneumoniae* Invasive Disease network), a pilot project aiming to set up active surveillance of IPD in EU/EEA to monitor the impact of PCV vaccination programmes.

Surveillance systems for IBD remain very diverse across Europe and this has an impact on the comparability of data between countries and the accuracy of data interpretation at European level. A better understanding of surveillance systems and laboratory practices in different Member States, as well as better linkage between notification and laboratory data at national level, would improve interpretation of the data.

Surveillance systems overview

Country	Data source	Compulsory (Cp)/Voluntary (V)/Other(O)	Comprehensive (Co)/Sentinel (Se)/Other(O)	Active (A)/Passive (P)	Case-Based (C)/Aggregated (A)	Data reported by				National coverage	Case definition used
						Laboratories	Physicians	Hospitals	Others		
Austria	AT-Epidemiegesetz	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2008
Belgium	BE-REFLAB	V	Se	A	C	Y	N	N	N	Y	EU-2008
Bulgaria	BG-NATIONAL_SURVEILLANCE	Cp	Co	P	A	Y	Y	Y	Y	Y	EU-2008
Cyprus	CY-LABNET	V	Se	A	C	Y	N	N	N	N	Not specified/unknown
Czech Republic	CZ-NRL-STR	Cp	Co	A	C	Y	Y	Y	N	Y	EU-2008
Denmark	DK-LAB	Cp	Co	P	C	Y	N	N	N	Y	Not specified/unknown
Estonia	EE-PNEUMOCOCC	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2008
Finland	FI-NIDR	Cp	Co	P	C	Y	N	N	N	Y	Not specified/unknown
France	FR-EPIBAC	V	Se	A	C	Y	N	Y	N	Y	EU-2008
Greece	GR-Notification/Laboratory data	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2008
Hungary	HU-NRL_PNEU	V	Co	P	C	Y	N	N	N	Y	EU-2008
Iceland	IS-SUBJECT_TO_REGISTRATION	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Ireland	IE-PNEU	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Italy	IT-MENINGITIS	Cp	Co	P	C	N	Y	Y	N	Y	EU-2008
Latvia	LV-BSN	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2012
Lithuania	LT-COMMUNICABLE_DISEASES	Cp	Co	P	C	Y	Y	N	N	Y	EU-2008
Luxembourg	LU-SYSTEM1	Cp	Co	P	C	N	Y	N	N	Y	EU-2002
Malta	MT-DISEASE_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	Y	Y	EU-2008
Netherlands	NL-NRBM	V	Se	P	C	Y	N	N	N	N	EU-2008
Norway	NO-MSIS_A	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2012
Poland	PL-NATIONAL_SURVEILLANCE	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Romania	RO-RNSSy	Cp	Co	P	C	N	N	Y	N	Y	EU-2008
Slovakia	SK-EPIS	Cp	Co	A	C	Y	Y	Y	N	Y	EU-2012
Slovenia	SI-SURVIVAL	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2008
Spain	ES-NRL	V	O	P	C	Y	N	Y	N	-	Not specified/unknown
Sweden	SE-SMINET	Cp	Co	P	C	Y	Y	Y	N	Y	EU-2012
United Kingdom	UK-PNEUMOCOCCAL	O	Co	P	C	Y	N	Y	Y	Y	EU-2012

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