

## SURVEILLANCE & MONITORING

# Invasive pneumococcal disease

## Annual Epidemiological Report for 2023

### Key facts

- In 2023, 24 567 confirmed cases of invasive pneumococcal disease (IPD) were reported in the European Union/European Economic Area.
- The crude notification rate was 6.8 cases per 100 000 population, the highest since 2019.
- Age-specific rates were highest in adults 65 years old and above (15.4 confirmed cases per 100 000 population), and infants under one year of age (12.9 confirmed cases per 100 000 population). Higher rates were reported in males over females in all age groups.
- Serotypes 19A, 3, 24F, 10A, 33F, 22F, 8, 22F and 38 were the most common in children under five years of age.
- Serotypes 3, 19A, 8, 22F and 6C were the most common in individuals aged 65 years and above.
- Of cases in those under five years old for whom serotype information was available, approximately 40% were caused by a PCV13/non-PCV10 serotype. This proportion has increased over the last five years.
- Among cases in 65 years olds and above with serotype information, 32% were caused by a PCV13/non-PCV10 serotype, 18% by a PCV20/non-PCV15 serotype and 27% by non PCV/PPV serotypes.

### Introduction

Pneumococcal diseases are symptomatic infections caused by the bacterium *Streptococcus pneumoniae* (*S. pneumoniae*), commonly referred to as pneumococcus. The term 'invasive pneumococcal disease' (IPD) is used for more severe clinical presentations that require the detection of the *S. pneumoniae* in normally sterile sites, such as bacteraemia, sepsis, meningitis, osteomyelitis, and others. Pneumococcal infections are major causes of communicable disease morbidity and mortality in Europe and globally, with the highest burden of disease in young children and older adults. A large proportion of IPD is vaccine preventable.

*S. pneumoniae* is classified into serotypes based on the polysaccharide capsule antigens. More than 100 immunologically distinct serotypes are known, and structurally related serotypes are grouped together and labelled alphabetically (e.g. 6A, 6B). Different serotypes are covered by different vaccines, as shown in Annex 1. All European Union/European Economic Area (EU/EEA) countries except Estonia have had a funded programme for children with one of the available pneumococcal conjugated vaccines (PCV). As of 2025, all countries, except Denmark, have had vaccination recommendations in place for adults with medical conditions at risk of pneumococcal diseases. Moreover, as of 2025, all countries, except Denmark and Finland, have had age-based vaccination recommendations in place for older individuals. For adults, vaccine recommendations vary in terms of which vaccines are/have been used among PCVs and/or polysaccharide vaccines, and which age groups are of focus [1].

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## Methods

This report is based on data for 2023 retrieved from EpiPulse Cases on 12 March 2025. EpiPulse Cases is a system for the collection, analysis and dissemination of data on communicable diseases; it replaced The European Surveillance System (TESSy) in October 2024.

For a detailed description of the methods used to produce this report, refer to the Methods chapter of the 'ECDC Annual Epidemiological Report [2]. An overview of the national surveillance systems is available online[3].

A subset of the data used for this report is available through ECDC's online 'Surveillance Atlas of Infectious Diseases [4].

In 2023, 29 EU/EEA countries reported data on IPD. Twenty-seven countries used the 2018 (11 countries), 2012 (6), or 2008 (10) EU case definition. For one country, the case definition was unknown/not specified and for one other it was reported as 'other'.

The 2018, 2012 and 2008 case definitions do not differ, with the exception of the note on antimicrobial resistance that was added to the 2018 case definition [5]. Antimicrobial susceptibility data were based on the reporting of susceptibility testing categories (Susceptible/Intermediate/Resistant) and minimum inhibitory concentration (MIC) data. MIC data were converted to SIR data based on EUCAST breakpoints [6].

National IPD surveillance systems were heterogeneous. Of the 29 countries reporting data, 23 conducted surveillance with compulsory reporting and national coverage. One country conducted surveillance with comprehensive reporting (Iceland, system coverage not specified), two used voluntary comprehensive systems (Hungary, Italy) and three used voluntary sentinel systems (Belgium, France, the Netherlands). Prior to 2022, Spain reported data from a Spanish voluntary surveillance system from the National Reference Laboratory which covers 80% of the population; however, from 2022, 100% of the population have been covered by a compulsory surveillance system. The population coverage of the Belgian surveillance system is unknown, so notification rates were not calculated. For France, notification rates between 2000 and 2012 were calculated using an estimate that 82% of the population were covered by the surveillance system; from 2013 onwards, notification rates were calculated using between 79–85% of the total population (with the exact proportion updated yearly). The Netherlands reported data from the Dutch voluntary surveillance system from the National Reference Laboratory. This system covered 25% of the Dutch population prior to 2020, and 28% of the population between 2020-2022 (inclusive). Hence notification rates were calculated on these proportions of the population for the years prior to 2023. From 2023, 100% of the population are covered by the surveillance system. Germany had a voluntary, laboratory-based surveillance system and did not report data to ECDC [7]. All countries except Belgium and Bulgaria reported case-based data.

## Epidemiology

In 2023, 24 567 confirmed cases of IPD were reported by 29 EU/EEA countries. The crude notification rate was 6.8 cases per 100 000 population (Table 1). Spain reported the highest number of confirmed cases (4 821 cases), followed by France (3 911), Poland (2 957) and the Netherlands (2 152). The Netherlands reported the highest notification rates (18.9 cases per 100 000 population) followed by Sweden (13.8), Finland (12.3), Norway (11.2) and Slovenia (11) (Table 1, Figure 1). Cyprus, Bulgaria, Greece, Malta and Romania had the lowest notification rates ranging between 0 and 0.4 per 100 000 population.

**Table 1. Confirmed invasive pneumococcal disease cases and rates per 100 000 population by country and year, EU/EEA, 2019–2023**

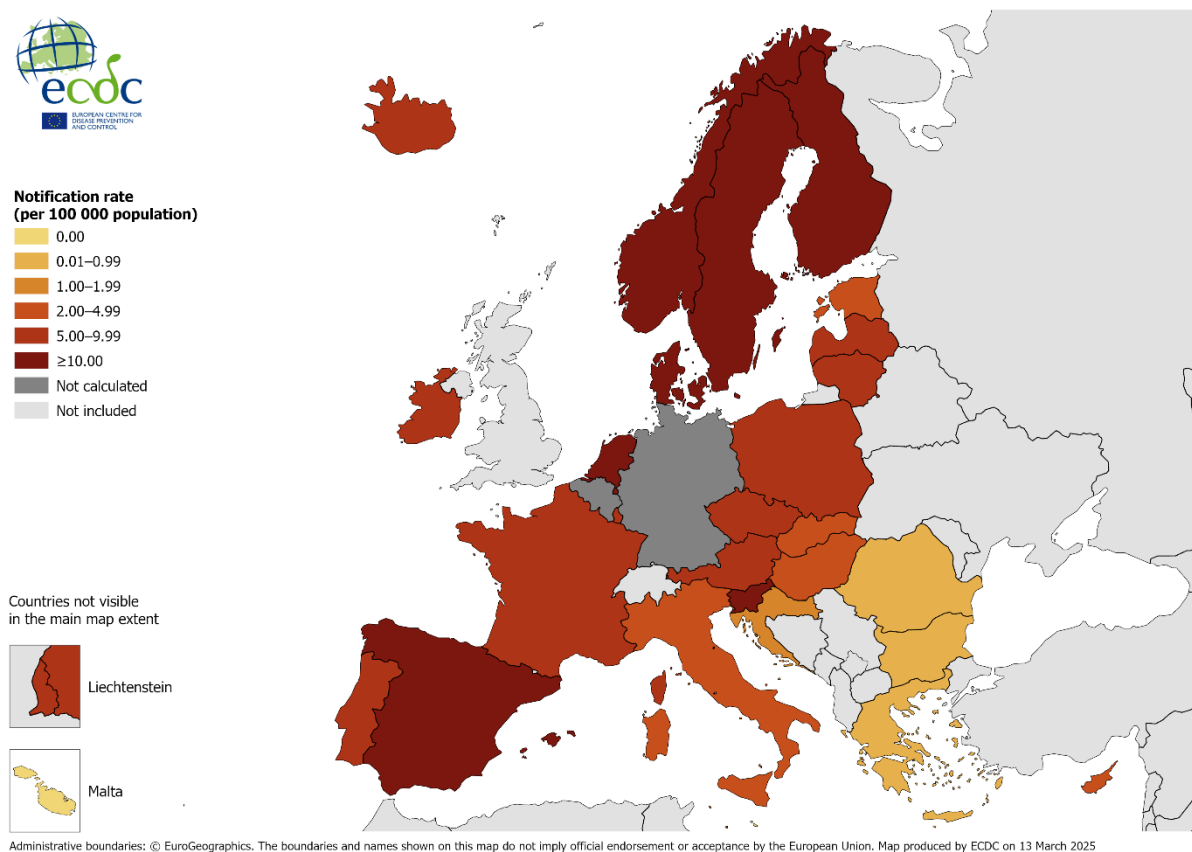
Country	2019		2020		2021		2022		2023		
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	ASR
Austria	615	6.9	355	4.0	398	4.5	558	6.2	759	8.3	7.4
Belgium	890	NRC	940	NRC	845	NRC	1 457	NRC	1 717	NRC	NRC
Bulgaria	34	0.5	11	0.2	3	0.0	7	0.1	20	0.3	0.3
Croatia	30	0.8	10	0.3	1	0.0	9	0.2	40	1.0	0.9
Cyprus	12	1.4	4	0.5	3	0.3	7	0.8	25	2.7	0.0
Czechia	481	4.5	247	2.3	264	2.5	472	4.5	585	5.4	4.9
Denmark	639	11.0	370	6.4	353	6.0	553	9.4	623	10.5	9.3
Estonia	61	4.6	24	1.8	15	1.1	39	2.9	32	2.3	2.2
Finland	748	13.6	318	5.8	309	5.6	582	10.5	684	12.3	11.0
France	3 907	7.3	2 193	4.1	2 067	3.7	3 387	5.9	3 911	6.3	6.3
Germany	NDR	NRC	NDR	NRC	NDR	NRC	NDR	NRC	NDR	NRC	NRC
Greece	47	0.4	17	0.2	18	0.2	28	0.3	43	0.4	0.4
Hungary	294	3.0	192	2.0	277	2.8	388	4.0	461	4.8	4.2
Iceland	41	11.5	20	5.5	17	4.6	36	9.6	36	9.3	9.9
Ireland	419	8.5	246	5.0	177	3.5	375	7.4	433	8.2	8.4
Italy	1 671	2.8	499	0.8	472	0.8	1 032	1.7	1 783	3.0	2.5
Latvia	83	4.3	67	3.5	70	3.7	125	6.7	149	7.9	7.1
Liechtenstein	NDR	NRC	NDR	NRC	1	2.6	5	12.7	2	5.0	4.2
Lithuania	0	0.0	0	0.0	25	0.9	88	3.1	142	5.0	4.5
Luxembourg	1	0.2	32	5.1	41	6.5	63	9.8	53	8.0	8.2
Malta	20	4.1	9	1.7	2	0.4	7	1.3	0	0.0	0.0
Netherlands	593	13.7	379	7.8	339	6.9	563	11.4	2 152	18.9	10.8
Norway	599	11.2	295	5.5	318	5.9	539	9.9	613	11.2	10.5
Poland	1 621	4.3	629	1.7	955	2.6	2 214	6.0	2 957	8.0	7.3
Portugal	490	4.8	251	2.4	241	2.3	446	4.3	599	5.7	4.9
Romania	72	0.4	25	0.1	10	0.1	39	0.2	63	0.3	0.3
Slovakia	124	2.3	55	1.0	35	0.6	92	1.7	176	3.2	3.1
Slovenia	280	13.5	175	8.3	187	8.9	224	10.6	233	11.0	9.4
Spain	2 465	6.6	1 031	2.7	795	2.1	3 132	6.6	4 821	10.0	9.3
Sweden	1 345	13.1	648	6.3	731	7.0	1 270	12.2	1 455	13.8	12.6
<b>EU/EEA (30 countries)</b>	<b>17 582</b>	<b>5.6</b>	<b>9 042</b>	<b>2.8</b>	<b>8 969</b>	<b>2.7</b>	<b>17 737</b>	<b>5.1</b>	<b>24 567</b>	<b>6.8</b>	<b>6.0</b>
United Kingdom <sup>a</sup>	5 622	8.4	NDR	NRC	NA	NA	NA	NA	NA	NA	NA
<b>EU/EEA (31 countries)</b>	<b>23 204</b>	<b>6.1</b>	<b>9 042</b>	<b>2.8</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

Source: Country reports.

ASR age standardised rate; NA: not applicable; NDR: no data reported; NRC: no rate calculated.

<sup>a</sup> No data from 2020 onwards were reported by the United Kingdom, due to its withdrawal from the EU on 31 January 2020.

**Figure 1. Confirmed invasive pneumococcal disease cases per 100 000 population by country, EU/EEA, 2023**

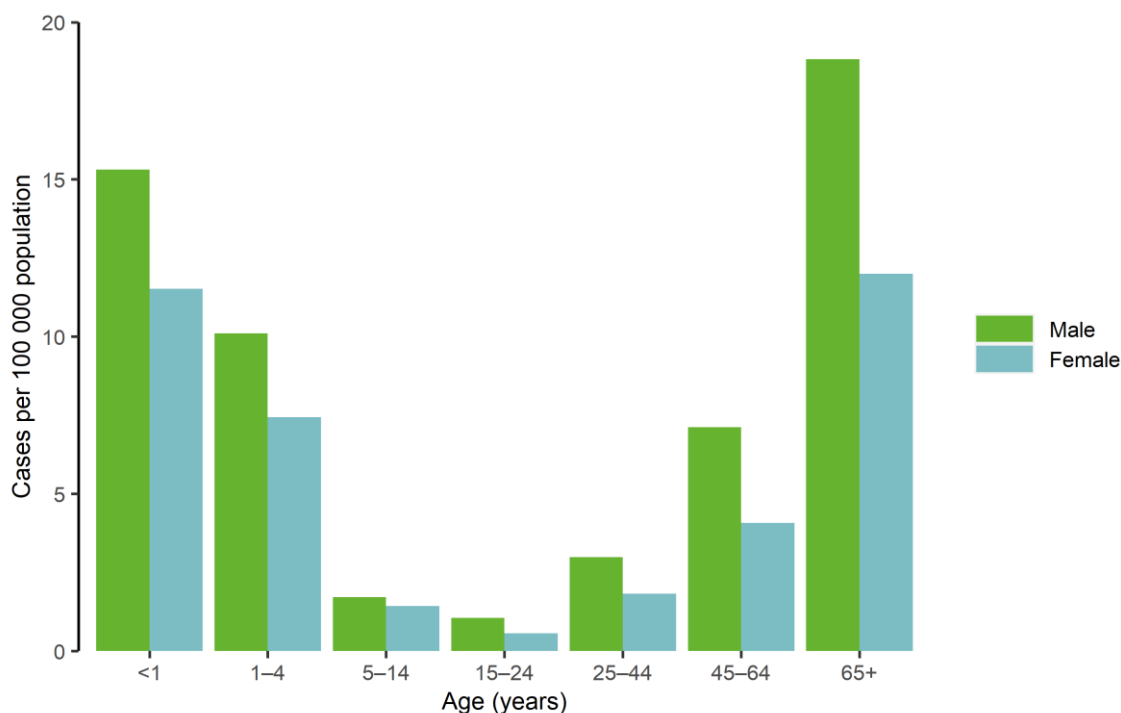


Source: Country reports

## Age and gender

In 2023, IPD was predominantly reported in older adults and infants, with 15.4 confirmed cases per 100 000 population in adults 65 years old and above and 12.9 confirmed cases per 100 000 population in infants under one year of age (Figure 2). The rates of disease were lowest in the 15–24 years age group (0.8 confirmed cases per 100 000 population) followed by the 5–14 years age group (1.6 confirmed cases per 100 000 population). The notification rate was higher in males in all age groups. The overall male-to-female ratio was 1.45:1.

**Figure 2. Confirmed invasive pneumococcal disease cases per 100 000 population, by age and gender, EU/EEA, 2023**

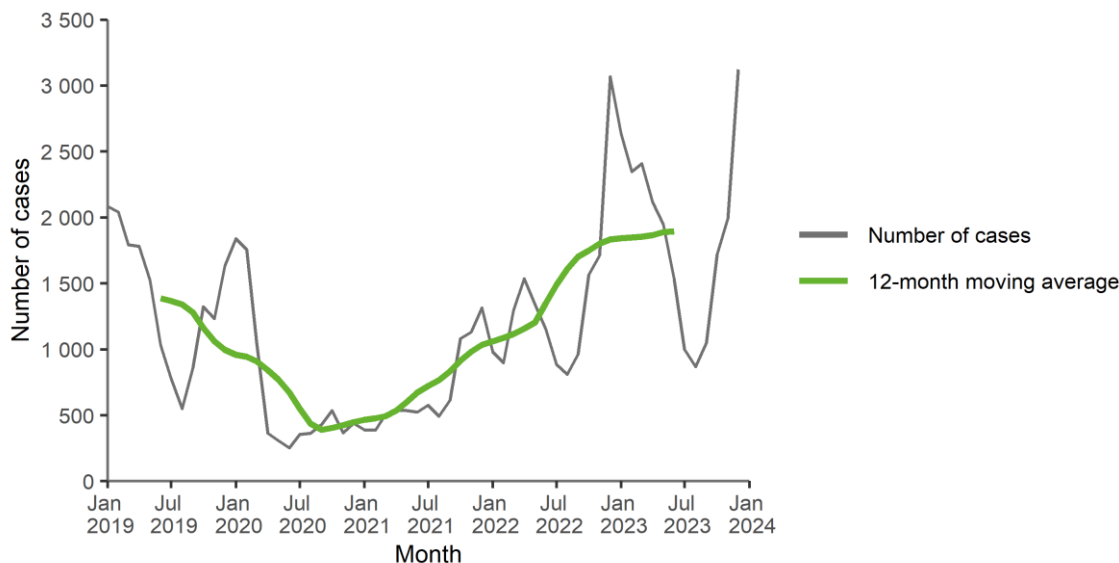


Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

## Seasonality and trend

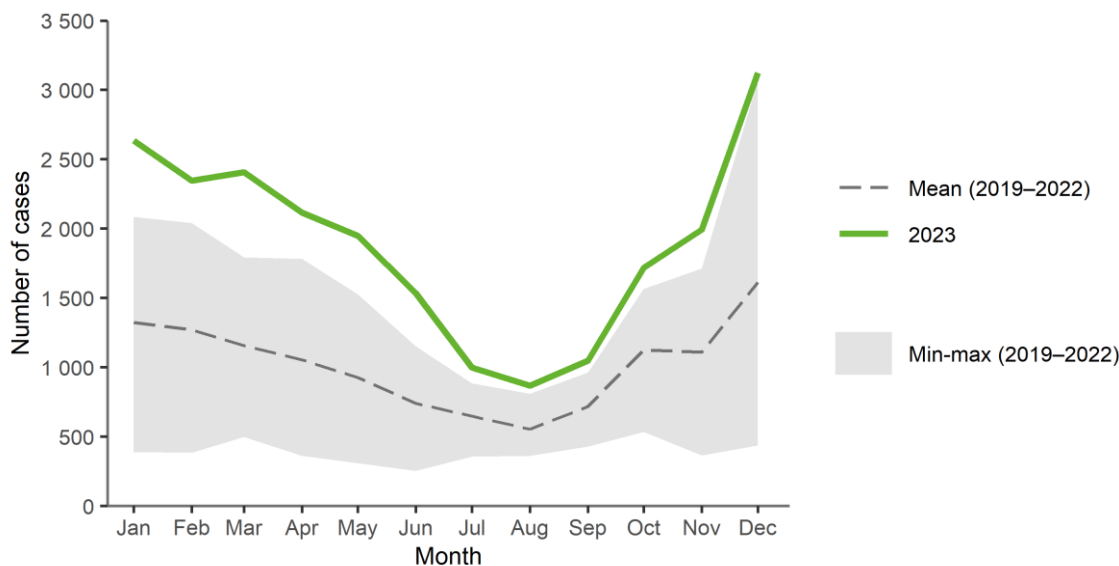
The seasonal distribution of IPD cases typically follows a pattern similar to many other respiratory diseases: case numbers are usually lowest during summer and then increase rapidly with the onset of autumn, peaking during the winter months (Figure 3). Compared with 2019, there was a sharp decrease in the number of reported cases during 2020 and 2021, coinciding with the COVID-19 pandemic. The number of cases increased over autumn/winter of 2022–2023 (Figures 3 and 4). In winter 2023, a sharp increase in cases was observed, peaking at 3 123 cases in December 2023. The overall activity in 2023 was higher in every month compared with the 2019–2022 trend (Figure 4).

**Figure 3. Confirmed invasive pneumococcal disease cases by month, EU/EEA, 2019–2023**



Source: Country reports from Austria, Cyprus, Czechia, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

**Figure 4. Confirmed invasive pneumococcal disease cases by month, EU/EEA, 2023 and 2019–2022**



Source: Country reports from Austria, Cyprus, Czechia, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

### Vaccination status

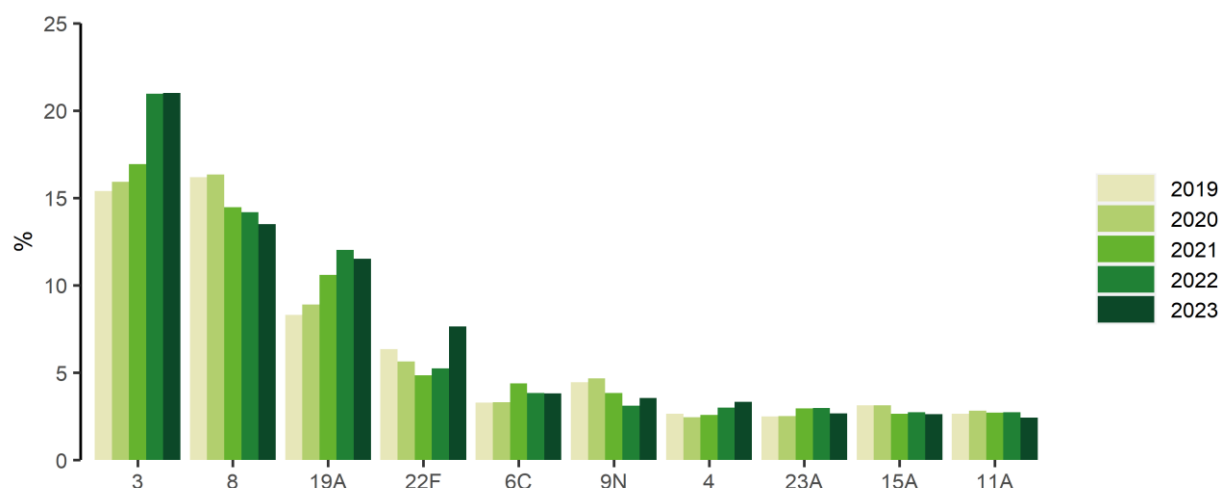
Data collected in relation to vaccination status of cases for the study period are limited. Vaccination status was reported for 46.3% (11 386 cases) of IPD cases reported in 2023. Of these, 71.2% (8 102 cases) were not vaccinated, 42.2% (4 800) had received between one to four doses of a PCV or PPSV vaccine, and another 7.7% (876) were reported as vaccinated with an unknown number of doses.

### Serotype

Among EU/EEA (n=23) countries that reported serotyping data in 2023, serotype was reported for 55.6% (13 711 cases) of cases, excluding non typable serotypes. The 10 most common serotypes, in order of decreasing frequency, were: 3, 8, 19A, 22F, 6C, 9N, 4, 23A, 15A, and 11A (Figure 5). These 10 serotypes accounted for 71.6% of all cases with a known serotype in 2023.

For countries that reported serotyping data consistently for each year of the reporting period, the distribution of serotypes between 2019 and 2023 is presented in Figure 5. Compared with 2019, there was an overall increase in the number of cases in all typable serotypes (from 2019 n=10 018 to 2023 n=13 711), and the highest increases were observed in serotypes 19A, 3, 4 and 22F with an increase of 90%, 87%, 72% and 65%, respectively, from 2019 to 2023.

**Figure 5. Confirmed serotyped cases of invasive pneumococcal disease, most common serotypes, EU/EEA, 2019–2023**



Source: Country reports from Austria, Cyprus, Czechia, Denmark, Estonia, Finland, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, and Sweden.

The distribution of serotypes varied according to the age groups affected. The five most common serotypes in each age group are presented in Table 2. For cases under one year of age, serotypes 19A, 3, 10A, 33F and 22F were predominant. Serotypes 19A and 3 were the most common in the one to four years age group. Serotypes 3, 8 and 19A were most common in individuals above five years of age.

**Table 2. Proportion of the five most frequent serotypes of confirmed cases of invasive pneumococcal disease by age group, EU/EEA, 2023**

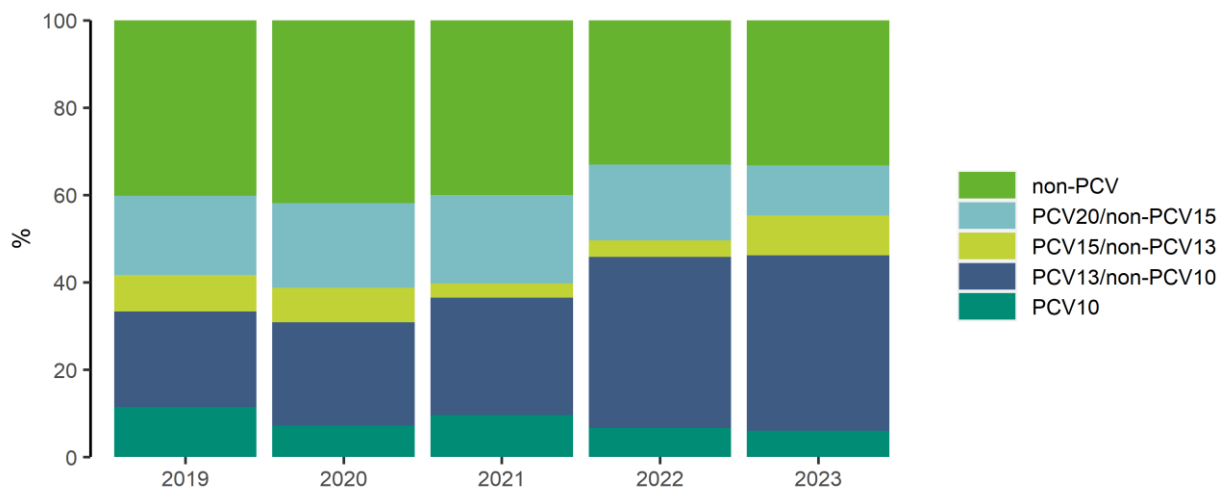
<1		1–4		5–14		15–24		25–44		45–64		65+	
Serotype	%	Serotype	%	Serotype	%	Serotype	%	Serotype	%	Serotype	%	Serotype	%
19A	17.1	19A	22.3	3	22.2	8	24.7	8	20.9	3	21.3	3	21.8
3	13.8	3	21.1	19A	15.2	19A	14.0	3	17.8	8	18.2	19A	10.8
10A	6.0	24F	7.0	8	10.8	3	12.9	19A	12.4	19A	10.0	8	10.8
33F	6.0	22F	5.4	22F	7.4	4	9.6	4	6.8	22F	7.3	22F	8.3
22F	5.5	38	5.2	23B	4.7	22F	5.1	22F	6.5	4	5.8	6C	5.0

Source: Country reports from Austria, Cyprus, Czechia, Denmark, Estonia, Finland, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, and Sweden.

In 2023, 40% of cases in children under five years of age with serotype information were caused by a PCV13/non-PCV10 serotype, 9% by a PCV15/non-PCV13 serotype, 11% by a PCV20/non-PCV15 serotype, 6% by a PCV10 serotype and 33% by a serotype not included in any current authorised PCV vaccine (Figure 6). The serotypes included in each vaccine formulation are shown in Annex 1.

From 2019 to 2023, there was a substantial increase in the proportion of PCV13/non-PCV10 serotypes in children under five years of age (from 21% in 2019 to 40% in 2023) and slight increase in the proportion of PCV15/non-13 serotypes (from 8% to 9%). Conversely, there were decreases in the proportions of PCV10, PCV20/non-15 and non-PCV serotypes over this five-year period (Figure 6).

**Figure 6. confirmed serotyped cases of invasive pneumococcal disease aged <5 years by PCV type and year, EU/EEA, 2019–2023**



Source: Country reports from Austria, Czechia, Denmark, Estonia, Finland, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, and Sweden.

In 2023, among cases in adults 65 years of age and above with serotype information, 32% by a PCV13/non-PCV10 serotype, 9% by a PCV15/non-PCV13 serotype, 18% by a PCV20/non-PCV15 serotype, 6% by a PCV10 serotypes and 5% by a PPV23/non-PCV20 serotype. A total of 27% were non PCV/PPV serotypes (Figure 7).

From 2019 to 2023, in adults 65 years of age and above, the proportion of non-PCV/PPV serotypes remained steady, ranging between 27% and 30%. There was a 33% increase in the proportion of PCV13/non-10 serotypes, from 24% in 2019 to 32% in 2023. The proportion of PCV20/non-PCV15 reduced from 22% in 2019 to 18% in 2023.

**Figure 7. Confirmed serotyped cases of invasive pneumococcal disease aged ≥ 65 years by pneumococcal vaccine and year, EU/EEA, 2019–2023**



Source: Country reports from Austria, Czechia, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, and Sweden.

## Antimicrobial susceptibility

Penicillin susceptibility data were reported by 12 countries for 13.9% (3 413/24 567 cases) of IPD cases. Of these, 81.5% (2 782 cases) were reported as sensitive, 6.2% (212) as intermediate and 12.3% (419) as resistant.

Erythromycin susceptibility data were reported by 11 countries for 7.6% (1 859/24 567 cases) of their IPD cases. Of these, 79% (1 469 cases) were reported as sensitive, 0.1% (2) as intermediate and 20.9% (388) as resistant.

Cephalosporin susceptibility data were reported by 11 countries for 11.6% (2 846/24 567 cases) of their IPD cases. Of these, 86.3% (2 457 cases) were reported as sensitive, 3% (85) as intermediate and 10.7% (304) as resistant.

## Clinical presentation

Clinical presentation was known for 13 404 (54.4%) of all cases. Of these, bacteraemic pneumonia was reported in 5 374 cases (40.1%), septicaemia in 4 980 cases (37.2%), meningitis in 1 526 cases (11.4%), and meningitis and septicaemia in 432 cases (3.2%). A further 1 091 cases (8.1%) had other clinical presentations.

Among infants under one year of age, the most common two clinical presentations were meningitis (33.7%), followed by septicaemia (28.7%). The most common two clinical presentations in one to four-year-olds were septicaemia (34.5%) and bacteraemic pneumonia (27.2%). In adults 65 years old and above, it was bacteraemic pneumonia (44.6%) and septicaemia (36.4%).

## Outcome

Among 11 442 cases (46.4% of total cases) with known outcome in 2023, 1 545 individuals (6.3% of total cases) died. The case fatality was highest among cases in those who were 65 years old and above (8.6%) and in those between 45–64 years (4.8%). Among infants under one year old and in children one to four years old, the case fatality rates were 2.3% and 1.2%, respectively.

Among the 1 545 individuals who died, 600 (38.8%) presented with septicaemia, 519 (33.6%) with bacteraemic pneumonia, 96 (6.2%) with meningitis, 72 (4.7%) with meningitis and septicaemia, 111 (7.2%) with other clinical presentations, and 147 (9.5%) with unknown clinical presentation.

Serotype was known for 1 117 (72.3%) deceased individuals with IPD. The five most common serotypes reported for this group (where serotype was known), in order of decreasing frequency, were 3, 8, 19A, 22F and 6C. These five serotypes accounted for 54.6% of deaths where serotype was known.

## Vaccination coverage

Vaccination coverage data for the third dose of pneumococcal vaccine (PCV3) in children were available up to 2024 for 26 EU/EEA countries, based on WHO (WUENIC estimates). In 2024, coverage ranged from 56% to 99%, and among those, 16 countries reported coverage of 90% and above. The majority of countries (n=21) reported the same or an increase in vaccination coverage compared to 2023. During the 2019-2024 period, Belgium, Denmark, France, Greece, Hungary, Italy, Luxembourg, Norway, Portugal, Slovakia, Spain and Sweden (n=12) reported steady vaccination coverage of  $\geq 90\%$  (Table 3).

Vaccination coverage rates in the adult population were collected as part of an ad-hoc pilot data collection performed in spring 2025 in the context of the ECDC NITAG Collaboration activity, and later validated by National Focal Points for Vaccine-preventable diseases. Vaccination coverage data were reported from 12 countries for the period 2019-2024, with some variability between the years. Only Germany was able to report vaccination coverage for individuals with chronic medical conditions for 2019-2024 (range: 19%-24%) (Table 4). Poland reported vaccination coverage of <3% in 2024 for the whole adult population without specifying the risk group with medical conditions. All EU/EEA countries implemented some form of vaccination for the older adult population in 2025, with variation in the age thresholds such as 60+ years, 65+ years or a specific age group (e.g. 60-69 years). In this context, vaccination coverage data among this age group were reported by 11 EU/EEA countries, ranging from <1% to 81% during 2019-2024 (Table 5).

**Table 3. Vaccination coverage (%) of third dose of pneumococcal vaccine (WUENIC) in the EU/EEA, 2019–2024**

Countries	2019	2020	2021	2022	2023	2024
Belgium	94	94	94	94	94	94
Bulgaria	88	85	86	87	87	91
Croatia			75	90	90	89
Cyprus	81	81	81	81	74	82
Denmark	97	96	96	96	97	96
Finland	89	86	82	87	87	87
France	93	95	95	96	96	96
Germany	82	82	82	72	74	75
Greece	96	96	96	93	90	90
Hungary	99	99	99	99	99	99
Iceland	92	93	92	84	92	93
Ireland	86	87	85	84	83	84
Italy	92	91	91	92	92	90
Latvia	84	91	92	87	95	92
Lithuania	82	83	82	81	82	87
Luxembourg	96	96	96	97	97	97
Malta			64	45	71	97
Netherlands	93	93	93	90	88	88
Norway	95	96	96	95	95	95
Poland	89	88	88	88	89	89
Portugal	98	98	98	98	98	98
Romania	88	85	85	85	78	78
Slovakia	97	96	97	96	96	96
Slovenia	65	70	58	61	58	56
Spain	94	94	93	95	92	92
Sweden	97	97	97	94	94	94

Source: WHO Immunization Data Portal, WHO and UNICEF Estimates of National Immunization Coverage (WUENIC) [8].

**Table 4. Pneumococcal vaccination coverage (%) in adults with underlying medical conditions, EU/EEA countries**

Country	2019	2020	2021	2022	2023	2024
Germany	19	23	23	23	23	24

Source ECDC April 2025.

**Table 5. Pneumococcal vaccination coverage (%) in older adults, EU/EEA countries**

Countries	2019	2020	2021	2022	2023	2024
Czechia	6.3	4.9	2.4	2.0	2.4	3.0
Denmark	6	64	73	81	78	74
Finland	2.2	5.1	1.1	0.8	1.5	1.5
Germany	16	19	19	20	19	21
Iceland	20.6	25.6	28.9	28.8	29.7	29.5
Lithuania						5
Netherlands <sup>a</sup>		73	74	63	56	45
Norway	8	21	24	27	30	30
Portugal	13.1	16.5	17.5	19.5	21.3	23.9
Slovenia	1.3	2.3	2.6	3.2	5.2	7.1
Spain <sup>b</sup>	25.9	24.8	21.4	39.4	42.9	46.7

Source: ECDC April 2025 and <sup>a</sup>Laarman et al. (2024) [9].

<sup>b</sup> In Spain, 2019, 2020 and 2021 data are of pneumococcal polysaccharide vaccine only.

## Discussion

In 2023, 29 EU/EEA countries reported a total of 24 567 cases of IPD corresponding to a crude IPD notification rate of 6.8 cases per 100 000 population. The level of notification was the highest in the last 5-year period (2019-2023), similar to the level of notification rates observed pre-COVID-19. Older adults (65 years old and above) and infants (under one year old) were the most affected age groups, with notification rates of 15.4 and 12.9 cases per 100 000 population, respectively. Notification rates varied by country, ranging from 0.0 to 18.9 cases per 100 000 population. The variation may reflect differences in healthcare systems, vaccination programmes, case ascertainment (including blood culturing practices) and reporting.

Most notified IPD were caused by vaccine preventable serotypes regardless of the age group under surveillance. This underscores the importance of ensuring effective implementation of pneumococcal vaccination programmes and the availability of national and subnational vaccination coverage indicators to assess equitable implementation of vaccination programmes the EU/EEA.

A recent global impact study including EU data demonstrated that, in children under five years of age, the incidence of invasive pneumococcal disease (IPD) caused by any serotype declined by 58-74% within six years following the introduction of the 10-valent or 13-valent pneumococcal conjugate vaccines (PCVs) [10]. Despite these encouraging results, IPD in children under five in the EU/EEA in 2023 remained predominantly associated with vaccine preventable serotypes 3 and 19A.

Vaccination coverage among children by two years of age varied across European countries, ranging from 56% to 99% in 2024 (excluding Austria, Czechia, Estonia and Liechtenstein due to missing data) [8]. These disparities highlight the need to further strengthen uptake and programme deployment.

The continued burden of serotype 19A in 2023 in children may be partly attributed to the use of the PCV10 during the study period, which does not include this serotype, though it is covered by higher-valent vaccines. Meanwhile, the persistent prevalence of serotype 3 likely reflects the low immunogenicity of current PCVs against this serotype [11,12]. Serotype 22F has consistently ranked among the five most common serotypes across all age groups, and its inclusion in the higher valency available vaccines is expected to contribute to reducing the IPD burden associated with this serotype. Higher valency PCVs are being included gradually in the vaccination programmes to expand serotype coverage, but their effectiveness and impact (against the above prevalent serotypes) remain to be documented.

Among adults aged 65 years and older, serotypes 3, 19A, 8, and 22F were the most frequently detected and collectively accounted for approximately 50% of IPD cases with reported serotype information. This proportion has remained stable over time. All four serotypes are vaccine preventable, being included in both the PPV23 [13] and the 20-valent PCV [14] and 21-valent vaccines [15].

The diversity of vaccine products and differences in their rollout in national programmes highlight the importance of enhancing the quality and completeness of surveillance data, essential to conduct more in-depth analyses on the IPD epidemiology and the vaccination impact.

## Public health implications

The post-pandemic increase in the number of cases and notification rates in many countries highlights the importance of vaccination as the primary intervention for IPD control. As demonstrated with early formulations of conjugated vaccines, the impact of PCV vaccination programmes is observed not only among vaccinated individuals, but also within populations who are not vaccinated. However, the occurrence of serotype replacement further complicates the impact evaluation. While decisions to introduce vaccines into national immunisation programmes should rely on country-specific considerations, such as disease burden, circulating serotypes, and cost-effectiveness, a higher-quality, enhanced national surveillance in all age groups is essential to measure the overall impact of these programmes at EU/EEA level.

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## Annex 1. Vaccine composition

There are a number of pneumococcal conjugate vaccines (PCVs) and a pneumococcal polysaccharide vaccine (PPV) currently and previously authorised for use in the EU/EEA. The available vaccine formulations protect against different serotypes (Table 1A).

**Table 1A. Composition of pneumococcal conjugate vaccines (PCVs) and pneumococcal polysaccharide vaccine (PPV) currently/previously authorised in the EU/EEA, by vaccine formulation and serotype**

		Serotype																							
		1	2	3	4	5	6A <sup>a</sup>	6B	7F	8	9N	9V	10 A	11 A	12 F	14	15 B	17 F	18 C	19 A	19 F	20	22 F	23 F	33 F
Vaccine formulation	PCV 7				X		(X)	X				X				X			X		X			X	
	PCV 10	X			X	X	(X)	X	X			X				X			X		X			X	
	PCV 13	X		X	X	X	X	X	X			X				X			X	X	X			X	
	PCV 15	X		X	X	X	X	X	X			X				X			X	X	X		X	X	X
	PCV 20	X		X	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X		X	X	X
	PPV 23	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

X: the vaccine formulation protects against this serotype.

<sup>a</sup> Although serotype 6A is not included in PCV7 or PCV10, it is considered to be a PCV7/PCV10 serotype in the analysis due to documented cross-protection provided by the serotype 6B antigen in PCV7/PCV10 [16].