

SURVEILLANCE REPORT

Haemophilus influenzae disease

Annual Epidemiological Report for 2023

Key facts

- In 2023, 5,234 confirmed cases of invasive *Haemophilus influenzae* disease were reported in the EU/EEA, representing a continued increase compared to the previous year (3 983 in 2022) and a substantial rise from pandemic-era figures (1 693 in 2021, 1 838 in 2020), coinciding with the post-COVID-19 return to typical respiratory disease transmission patterns.
- The notification rate rose to 1.2 cases per 100 000 population, the highest observed in the past five years, up from 0.9 in 2022 and 0.4 in both 2020 and 2021.
- Age-specific rates remained highest among infants under one year of age (6.41 per 100 000 population), followed by those aged 65 years and older (3.2 per 100 000 population).
- Serotyping data were available for 60% of cases. Among cases with known serotype, non-capsulated strains continued to dominate, accounting for 81% of infections. Serotype f was the most frequent capsulated strain, responsible for 6% (194 cases) of all cases, followed by serotype b 5% (164 cases).
- In 2023, serotype b (Hib) represented 5% of known serotyped cases, reflecting a slight decline from 9.1% in 2022. The low proportion of serotype b (Hib) reported continues to reflect the strong effect of the Hib vaccination programmes in EU/EEA countries.

Introduction:

Invasive *Haemophilus influenzae* is a bacterium that can cause severe bacterial infections, particularly in the case of the type b strain, that affects both children and adults, with young children being most at risk. The bacteria can cause a number of serious conditions including meningitis, septicaemia, pneumonia, and epiglottitis. [1].

Invasive *Haemophilus influenzae*, particularly type B (Hib), causes severe infections such as meningitis, pneumonia, septicaemia, and epiglottitis, especially in young children. Humans are the only known reservoir, and transmission occurs through respiratory droplets or secretions. Although the incubation period is not well defined, disease usually develops within a week of exposure. The mortality rate can be to 5-10% in industrialised countries and as high as 40% in low-resource settings. Survivors may experience long-term complications, including neurological and developmental impairments. Since the introduction of the Hib vaccine in the 1980s, routine immunisation in the EU/EEA has nearly eradicated Hib-related meningitis in young children. Nevertheless, vigilance remains essential, with treatment relying on antibiotics; antibiotic prophylaxis is recommended for close contacts.

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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 newly introduced system for the collection, analysis and dissemination of data on communicable diseases that replaced The European Surveillance System (TESSy) in October 2024. An overview of the national surveillance systems is available online [2]. A subset of the data used for this report is available through ECDC's online Surveillance atlas of infectious diseases and downloadable [3].

In 2023, 30 EU/EEA Member States reported data on invasive *H. influenzae* disease to ECDC. Most of the Member States reported data using the EU case definition (Commission Implementing Decision 2018/945/EU of 22 June 2018 of the European Parliament and of the Council) or a case definition compatible with the EU case definition for confirmed cases. For Greece the case definition was not specified/unknown, and Germany used another case definition [2]. The majority of Member States reported data from comprehensive, passive surveillance systems with national coverage. Belgium reported aggregated data [2].

Haemophilus influenzae type b vaccination coverage estimates presented in this report were retrieved from the WHO Global Health Observatory website. [4]

Epidemiology

In 2023, 30 EU/EEA countries reported a total of 5 234 confirmed cases of invasive *Haemophilus influenzae* disease, marking a continued increase from the 3 983 cases reported in 2022, and nearly tripling the numbers seen in 2021 (1 693) and 2020 (1 838) (Table 1). The overall notification rate for the EU/EEA reached 1.2 cases per 100 000 population. The highest notification rates were observed in Denmark (2.3 per 100 000), Lithuania (2.1), and Sweden (2.1) (Table 1, Figure 1).

France (883 cases), Germany (1 456), and Italy (315) together accounted for 51% (2 663 cases) of all confirmed cases in the EU/EEA. By contrast, countries such as Croatia (1), Cyprus (2), Estonia (3) and Malta (2) continued to report very few or no cases, Lichtenstein reported zero cases in 2023.

Table 1. Confirmed Haemophilus influenzae 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	64	0.7	28	0.3	31	0.3	77	0.9	115	1.3	1.1
Belgium	76	NRC	27	NRC	38	NRC	146	NRC	205	NRC	NRC
Bulgaria	3	0.0	0	0.0	0	0.0	1	0.0	2	0.0	0.0
Croatia	1	0.0	0	0.0	0	0.0	0	0.0	1	0.0	0.0
Cyprus	0	0.0	0	0.0	1	0.1	3	0.3	2	0.2	0.2
Czechia	25	0.2	22	0.2	10	0.1	46	0.4	54	0.5	0.5
Denmark	115	2.0	59	1.0	101	1.7	117	2.0	137	2.3	2.1
Estonia	3	0.2	2	0.2	1	0.1	7	0.5	3	0.2	0.2
Finland	77	1.4	41	0.7	15	0.3	78	1.4	55	1.0	0.9
France	694	1.2	399	0.7	434	0.7	731	1.2	883	1.4	1.4
Germany	951	1.1	509	0.6	361	0.4	983	1.2	1 465	1.7	1.4
Greece	5	0.0	2	0.0	6	0.1	9	0.1	17	0.2	0.1
Hungary	24	0.2	10	0.1	15	0.2	40	0.4	65	0.7	0.6
Iceland	8	2.2	5	1.4	7	1.9	8	2.1	6	1.5	1.5
Ireland	63	1.3	31	0.6	16	0.3	65	1.3	71	1.3	1.3
Italy	185	0.3	76	0.1	66	0.1	191	0.3	315	0.5	0.5
Latvia	4	0.2	1	0.1	1	0.1	13	0.7	6	0.3	NRC
Liechtenstein	NDR	NRC	NDR	NRC	2	5.1	0	0.0	0	0.0	0.0
Lithuania	3	0.1	0	0.0	2	0.1	58	2.1	60	2.1	2.0
Luxembourg	0	0.0	3	0.5	3	0.5	10	1.5	11	1.7	1.7
Malta	3	0.6	0	0.0	0	0.0	0	0.0	2	0.4	0.4
Netherlands	227	1.3	203	1.2	166	0.9	320	1.8	316	1.8	1.6
Norway	98	1.8	40	0.7	58	1.1	133	2.5	126	2.3	2.2
Poland	102	0.3	78	0.2	52	0.1	149	0.4	264	0.7	0.7
Portugal	42	0.4	35	0.3	42	0.4	62	0.6	77	0.7	0.7
Romania	0	0.0	1	0.0	0	0.0	12	0.1	18	0.1	0.1
Slovakia	8	0.1	5	0.1	1	0.0	9	0.2	24	0.4	0.4
Slovenia	24	1.2	11	0.5	15	0.7	29	1.4	31	1.5	1.3
Spain	245	0.6	161	0.4	171	0.4	462	1.0	678	1.4	1.3
Sweden	259	2.5	89	0.9	78	0.8	224	2.1	225	2.1	1.9
EU/EEA (30 countries)	3 309	0.8	1 838	0.4	1 693	0.4	3 983	0.9	5 234	1.2	1.0
United Kingdom	NDR	NRC	NDR	NRC	NA	NA	NA	NA	NA	NA	NA
EU/EEA (31 countries)	3 309	0.8	1 838	0.4	NA	NA	NA	NA	NA	NA	NA

Source: Country reports.

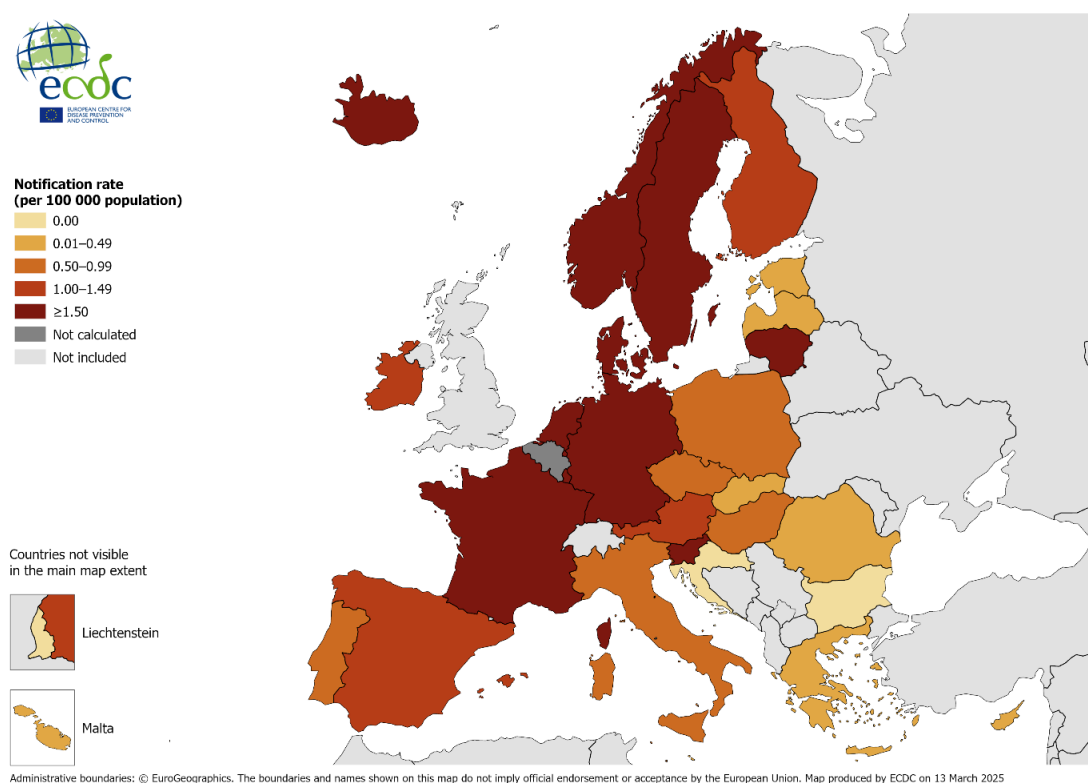
NDR: No data reported.

NRC: No rate calculated.

NA: Not applicable.

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 *Haemophilus influenzae* disease cases per 100 000 population by country, EU/EEA, 2023

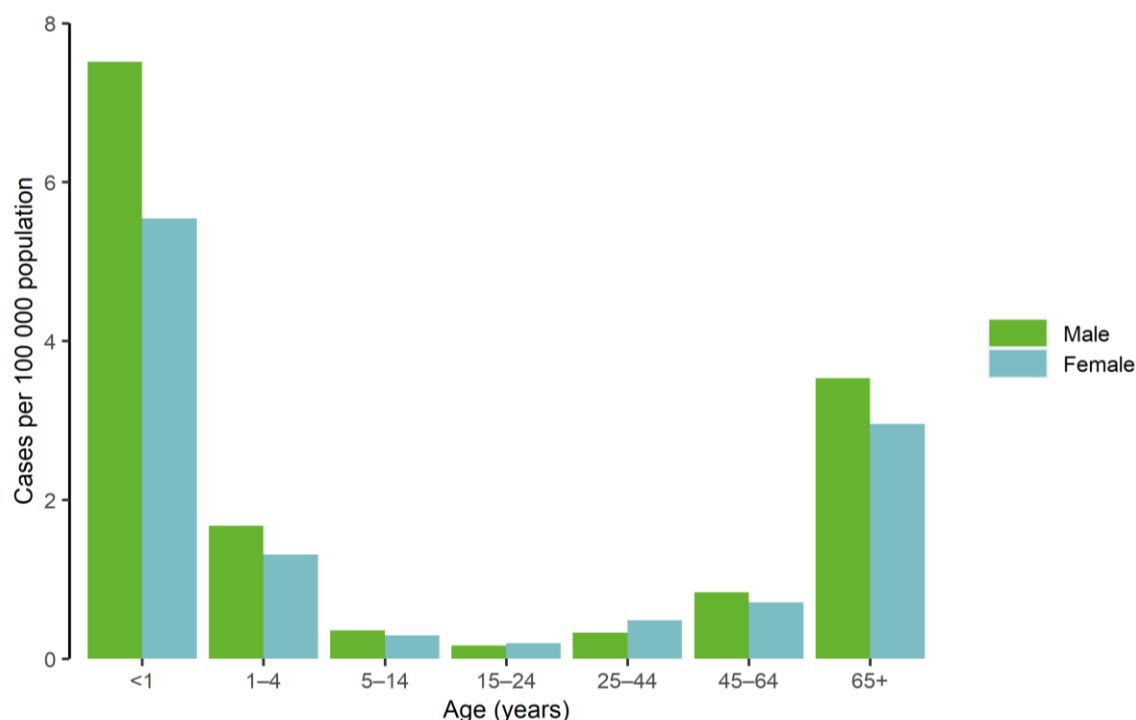


Age and gender distribution

In 2023, invasive *Haemophilus influenzae* disease showed a clear age-related pattern. The highest notification rate was reported in infants under one year of age (6.41 per 100 000 population). Rates declined steeply thereafter: 1.49 in children aged 1–4 years, 0.33 in those aged 5–14, and 0.18 in the 15–24 age group. A gradual increase followed among older adults, with notification rates of 0.41 in the 25–44 age group, 0.77 in 45–64, and 3.2 among those aged 65 and over. Case distribution mirrored this trend, with those 65 years and older comprising 58.7% of all reported cases, followed by adults aged 45–64 (18.6%). Despite the relatively small proportion of cases in infants, the disease burden per population was highest in this age group, indicating a bimodal distribution with peaks in the very young and those over 65 years.

Across most age groups (all groups except 15–24, 25–44 years), males exhibited higher notification rates than females. The most pronounced difference was observed in infants under one year of age, with rates of 7.3 per 100 000 for males compared to 5.4 for females. This male predominance persisted across childhood and adult age groups, although the difference narrowed in the 15–44 age range, where females slightly outnumbered males in some groups. Among adults aged 65 and above, the male notification rate remained higher (3.5 vs 2.9 per 100 000). (Figure 2).

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

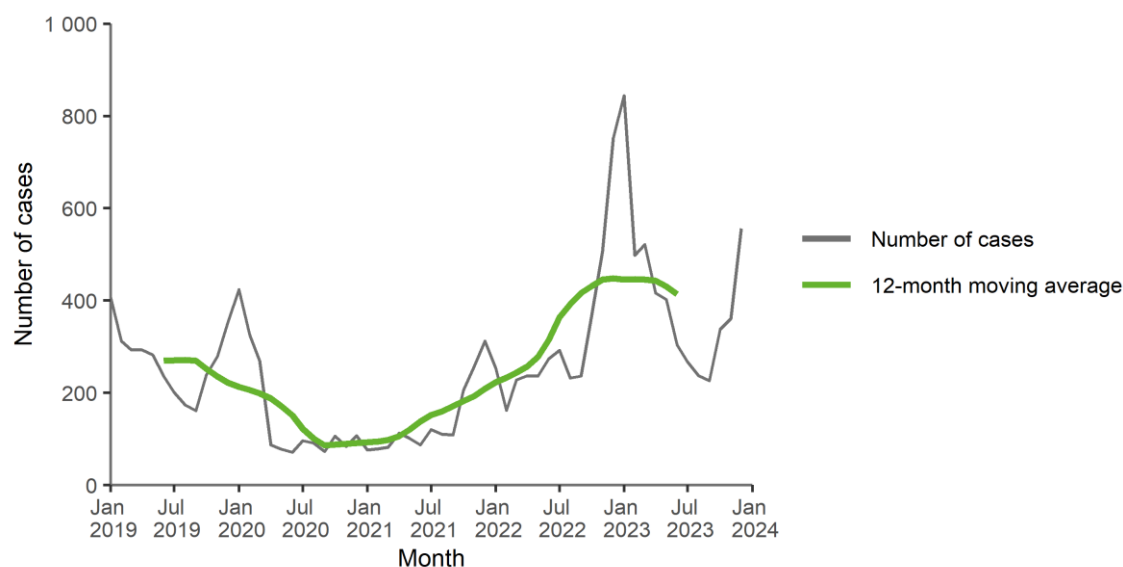


Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain,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

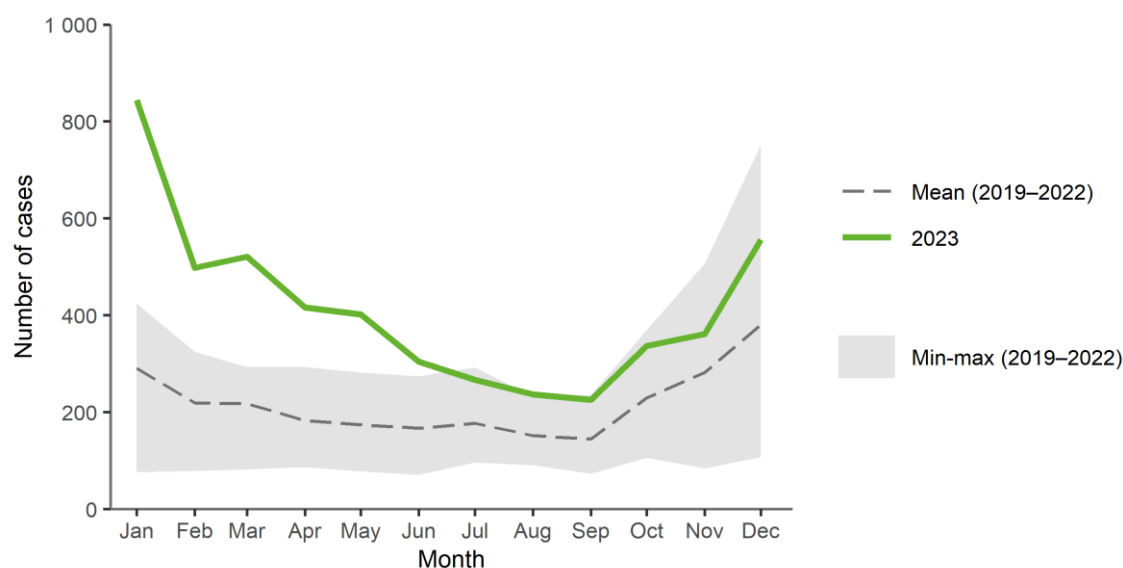
Seasonality and trend

Figure 3 indicates that the distribution of invasive *Haemophilus influenzae* cases in 2023 returned to a more typical seasonal pattern, with the highest number of cases recorded during the winter months (late 2022 and early 2023), followed by a decline through the summer. Toward the end of 2023, case numbers began to rise again, reflecting the re-emergence of the characteristic winter peak. The 12-month moving average continued its upward trajectory from mid-2022, reaching a peak in early 2023 before plateauing, confirming a sustained period of elevated transmission.

Figure 4 shows the monthly case counts in 2023 compared to the mean and range from the previous four years (2019–2022). Case numbers started the year well above the five year average, particularly in January, and remained elevated through the first quarter. During the summer, reported cases dropped but stayed near or just above the upper range of previous years. From September onward, cases began increasing again, and the number of cases remained above the five year average, but at the same time below the maximum number of cases reported for the same period in the past four years.

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

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

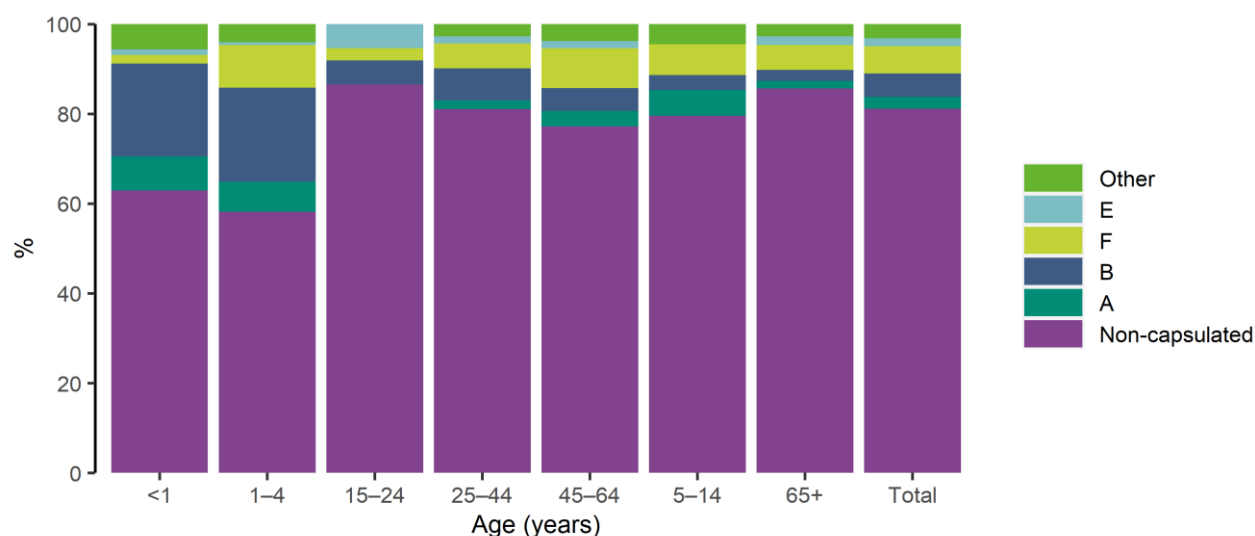
Figure 4. Confirmed *Haemophilus influenzae* disease cases by month, EU/EEA, 2023 and 2019–2022

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

Serotype

In 2023, there were 3 149 cases of invasive *Haemophilus influenzae* disease cases with known serotype (60%). The non-capsulated was the main type with 2 552 cases (81%), Serotype b (Hib) was registered in 164 cases (5%) and was more apparent among the youngest, particularly in children under one year of age (33 cases) which represent (21%) of the cases with known serotype in this age group, children between 1-4 years (31 cases) which represent (20%) of the cases with known serotype in this age group. Serotype f accounted for 6% of cases (194 cases), while other types were serotype e (4%), serotype a accounted for 2% (83 cases), and other serotypes (c, d) together accounted for a smaller portion of cases, consistently across all age groups (141 cases in total). (Figure 5). The highest proportion of serotype a was observed in children below the age of 5 years and for serotype f the highest proportion were observed in children between 1 and 4 years and individuals between 45 and 64 years.

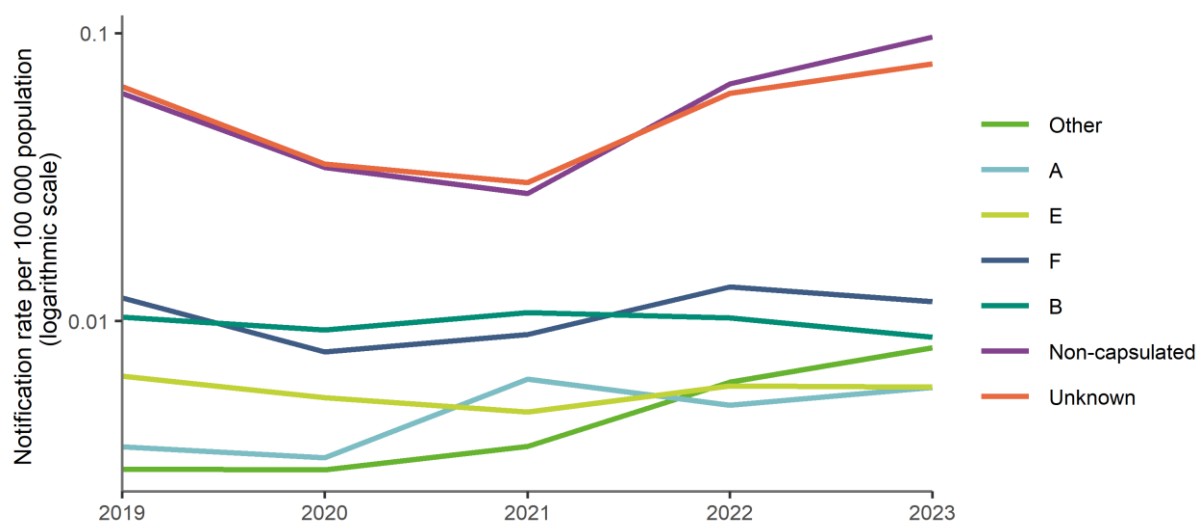
Figure 5. Serotype distribution of confirmed *Haemophilus influenzae* disease cases by age group, EU/EEA, 2023



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

Figure 6 shows the notification rates per 100 000 population for different serotypes of invasive *Haemophilus influenzae* from 2019 to 2023. Non-capsulated strains remained the most prevalent group, with notification rates continuing to rise annually and peaking in 2023 at 0.10 per 100 000 population. For serotype b between 2019 and 2023, serotype b incidence has been at stable levels, almost plateauing. Serotypes f and e showed more but not dramatic fluctuating trends between 2019 and 2023: serotype f declined from its peak in 2022 (0.013) to 0.012 in 2023, and serotype e remained stable (approximately 0.006). Serotype a remained at a low rate in 2023 (0.006) similar to previous years (2022: 0.005, 2021: 0.006), however marking an increasing trend from 2019 where a notification of (0.004) was observed. The 'Other' serotypes group rose for a second consecutive year, reaching 0.007 in 2023. Meanwhile, the notification rate for cases with unknown serotype increased again in 2023 to 0.078 per 100 000 population, the highest level in the five-year period.

Figure 6. Notification rate of confirmed *Haemophilus influenzae* disease per 100 000 population, by serotype and year, EU/EEA, 2019–2023



Source: Country reports from Austria, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Liechtenstein, the Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden.

Clinical presentation

In 2023, out of 5 234 confirmed cases of invasive *Haemophilus influenzae* disease, clinical presentation was reported for 2 595 cases (50%). The most common presentation was pneumonia, recorded in 638 cases (25%), followed by septicaemia with 606 cases (23%). Meningitis was reported in 346 cases (13%), while 56 cases (2%) presented with both meningitis and septicaemia. Less frequent manifestations included osteomyelitis or septic arthritis (11 cases; 0.4%), epiglottitis (six cases; 0.2%), and cellulitis (12 cases; 0.5%). A significant proportion of cases - 920 (36%) - were classified under 'other' clinical presentations. Clinical information remained unknown or unreported for half of the reported cases (2 639).

Outcome

In 2023, the outcome was reported for 2 875 cases (55%). Among these, 248 deaths were recorded, resulting in an overall case fatality rate (CFR) of 8.6%. Eight deaths occurred in infants under one year of age (CFR= 6.7%), and three deaths were reported among children aged 1–4 years (CFR= 2.2%). The majority of fatal outcomes were reported in individuals aged 65 years and older, with 198 deaths among 1 716 cases in this group (CFR= 11.5%).

When considering the outcome by serotype, CFRs varied across different groups. The highest CFR was observed for serotype e at 12.8% (five deaths among 39 cases), followed by serotype b at 8.2% (nine deaths among 110 cases), non-capsulated strains at 7.9% (139 deaths among 1 757 cases), serotype f at 5.0% (seven deaths among 140 cases), and serotype a at 3.5% (two deaths among 57 cases). One death was reported for serotype d.

When indicated, the majority of fatal cases were reported among unvaccinated individuals (n=128), corresponding to a case fatality rate (CFR) of 10%. Among those with known to be vaccinated with three doses of the vaccine, two deaths were reported (CFR = 2.7%), while one death occurred in a case with only one dose (CFR = 3.7%).

When analysing the fatal cases (n=248) per age group and vaccination status, it is notable that the majority of the fatality occurred in unvaccinated individuals (n=128, 52%), particularly among the age groups +65 years where unvaccinated cases accounted for 102 deaths (41% of the total). For 116 deaths (38%) in this age group the vaccination information was missing. Those 65 years and older comprised nearly 80% of all fatal outcomes, followed by age group 45-64 years (n=34, 13.7%), while children <1 year of age had eight fatal cases (3.2%), and three deaths (1.2%) were recorded for each of the age groups (1-4 years, and 25-44 years). The age group 5-14 years had the lowest number of fatal cases (n=2, 0.8%).

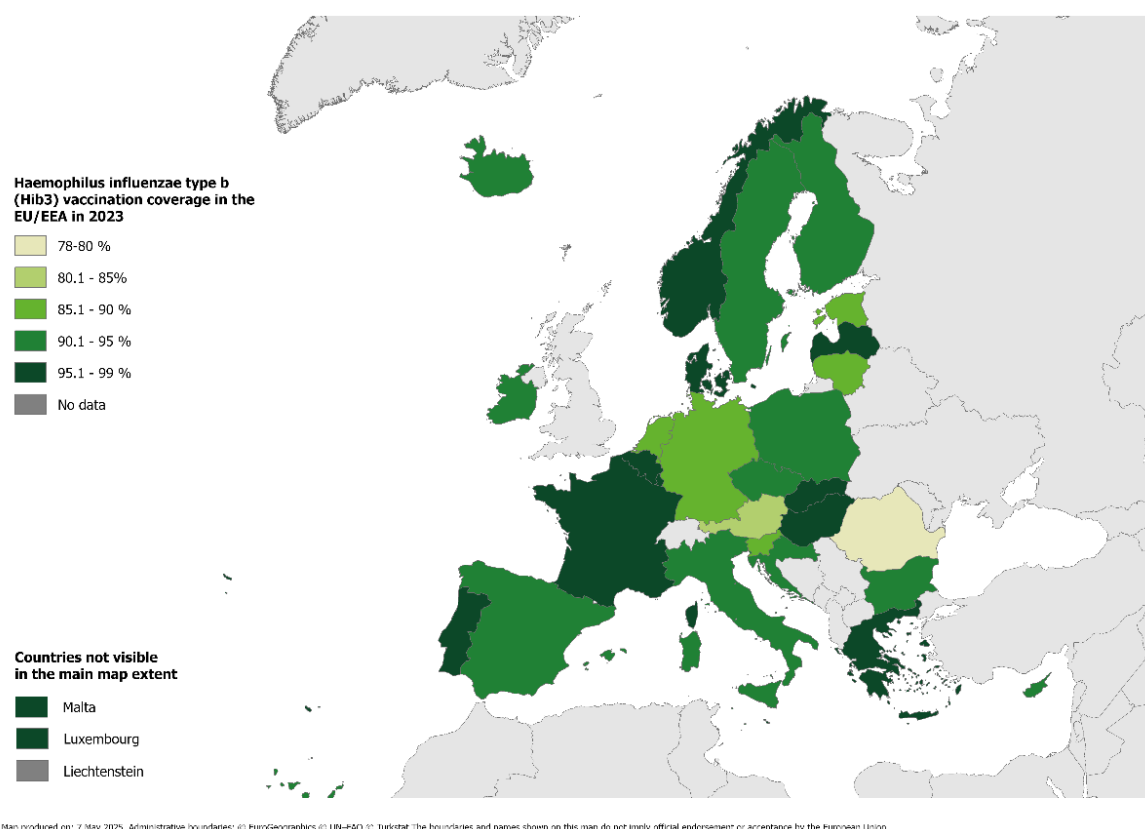
Vaccination status

In 2023, vaccination status was known for 1 468 of the 5 234 confirmed cases (28%) of invasive *Haemophilus influenzae* disease. Among those with known status, 187 cases (12.7%) had received at least one dose of a Hib-containing vaccine, while 1 281 cases (87.3%) were unvaccinated. The number of doses received varied, with 27 cases having received one dose, 25 having received two doses, 75 three doses, 43 four doses, and one case received five doses. Vaccination status was unknown for 16 cases (1.1%).

Among the serotype b cases (n= 164), the vaccination status was known for (n=124, 75%), six cases had one dose of the vaccine, thirteen cases had two doses, twenty-three cases had three or more doses, while the vast majority of the cases (n=83, 50%) were not vaccinated, and forty cases (24%) had unknown vaccination status.

Vaccination coverage

Figure 7 presents the WHO/UNICEF Estimates of Immunization Coverage for third dose of *Haemophilus influenzae* type b (Hib3) vaccine across EU/EEA countries in 2023 (WUENIC estimates). Median Hib3 coverage in the EU/EEA was 94%, with country-specific estimates ranging from 78% to 99%.

Figure 7. Vaccination coverage of third dose of Hib-containing vaccine, EU/EEA 2023 (Source: WUENIC, WHO)

Discussion

In 2023, the EU/EEA reported 5 234 confirmed cases of invasive *Haemophilus influenzae* disease. Compared to the pre-COVID-19 pandemic period, the number of cases in 2023 represents a significant increase in the number of cases compared to the 2013-2018 period (range 2 593–3 849), in addition it is the highest number of cases reported in one year since the surveillance on EU/EEA level started in 1996 [3]. COVID-19 public health control measures [5, 6] have been associated with a decline in the notification of cases of invasive *Haemophilus influenzae* disease. In 2023 as in previous years, the disease burden remained concentrated among infants under one year and adults aged 65 years and over, underscoring the persistent vulnerability of these age groups [7].

A notably high proportion of serotype b cases were reported in children less than four-year-old. In infants, our data did not permit to determine which infants were too young to be eligible to the vaccine or if vaccinated cases aged 1-4-year-old received a booster dose of the vaccine. Indeed, the third dose of vaccination against *Haemophilus influenzae* disease may represent the first booster or the third dose of a primary course, depending on the schedule adapted by the country (2+1 or 3+1). The effectiveness of each programme to prevent the disease in young children will benefit to be further documented [8, 9].

The continued expansion of non-capsulated *H. influenzae* strains in 2023 further confirms their dominance in the post-Hib vaccine era [10]. This shift in serotypes may be partially attributed to strain replacement following the introduction of the Hib vaccines, improved detection methods, and demographic changes such as increased susceptibility among those 65 years and older [11]. Similarly, serotype f, which represented 6% of cases in 2023, continues to be the most common capsulated type, though its notification rate declined slightly compared to 2022. Moreover, an increasing trend has also been observed in cases grouped under 'other' serotypes, highlighting the need for more exhaustive and detailed serotyping to better understand emerging patterns. These developments support previous findings on serotype replacement and underscore the adaptive nature of *H. influenzae* epidemiology in the post-Hib vaccine era [12, 13].

For the data collected in 2023, the case fatality rate (CFR) among cases with known outcome was 8.6%, the infants under one year and older adults comprising the majority of fatal outcomes, a pattern consistent with the previous years [7]. Among serotypes, the highest CFR was observed in serotype e (12.8%), followed by serotype b (8.2%) and non-capsulated strains (7.9%). The relatively lower CFR of serotype b compared to serotype e may reflect evolving host susceptibility or changes in disease severity profiles [7, 8], and a higher frequency of serotype e in adults over 65 years.

The completeness of the data regarding clinical presentation, vaccination status, and outcome would benefit from improvement. In 2023, clinical presentation was known for only half of the cases, with pneumonia and septicaemia were the most frequently reported presentations, consistent with historical trends [7]. Regarding vaccination, data were available for only 1 in 4 of cases, among which the majority (9 of every 10 cases) were unvaccinated, which is similar to the trend in 2022. Moreover, the proportion of cases with unknown serotype and unknown vaccination status remained high in 2023 (approximately 34%, and 72%, respectively), limiting full epidemiological understanding.

For the EU/EEA countries, Hib median vaccination coverage (third dose) was estimated at 94% in 2023, which is similar to the median vaccination coverage recorded in 2022 and 2021 [4]. This sustained high coverage has been instrumental in maintaining low incidence of serotype b disease across all age groups. In line with this observation, Hib (serotype b) accounted for only 5% of serotyped cases in 2023, a decrease from 9.1% in 2022, and significantly lower than pre-vaccination levels. This sustained decline highlights the long-term impact of Hib vaccination in reducing morbidity and mortality in young children.

The occurrence of breakthrough infections among partially and fully vaccinated children—particularly in those under one year of age and in age group 1–4 years of age—highlights the need for the continues assessment of Hib vaccine effectiveness and the timing of protection during infancy [14]. These findings underscore the importance of ongoing surveillance and evaluation of immunisation schedules to ensure optimal protection in the most vulnerable age groups.

Historically, invasive *H. influenzae* disease predominantly involved serotype b infections in otherwise healthy children. However, following the widespread adoption of Hib vaccination across EU/EEA Member States—fully integrated since 2010—the epidemiological landscape has shifted [15–17]. The ongoing evolution in serotype distribution demands vigilant surveillance, enhanced microbiological monitoring, and continued investment in laboratory capacity to ensure accurate detection and reporting.

In conclusion, the rising burden of non-type b and non-capsulated strains requires continuous monitoring. High immunisation coverage must be maintained to prevent Hib resurgence, particularly among infants, while also exploring the development of expanded-valency or protein-based vaccines that target a broader spectrum of *H. influenzae* strains [18, 19]. The post-pandemic period highlights the interplay between immunity gaps, behavioural changes, and pathogen dynamics, reinforcing the need for flexible and inclusive vaccine policies that address both current and emerging threats.

Public health implications

The number of *Haemophilus influenzae* cases in the EU/EEA continued to rise in 2023, building on the increase observed in 2022 and marking a sustained rebound from the suppressed levels reported in 2020 and 2021, and over 25% of increase compared to the number of cases recorded in 2018.— While serotype b notification rate is plateauing, non-capsulated and non-type b strains have increased in incidence. Maintaining high Hib vaccination coverage among infants and young children remains essential, but must now be coupled with strengthened serotype surveillance, consideration of future vaccine development targeting broader strains, and improved protection strategies for vulnerable adult populations.

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