

SURVEILLANCE REPORT

Haemophilus influenzae disease

Annual Epidemiological Report for 2022

Key facts

- In 2022, 3 967 confirmed cases of invasive *Haemophilus influenzae* disease were reported in the EU/EEA, representing a significant increase compared to the previous two years (1 694 cases in 2021, 1 849 in 2020), observed in parallel to the lifting of COVID-19 restrictions and measures.
- The notification rate was 0.9 cases per 100 000 population, which is an increase on 2020 and 2021 when it was 0.4 cases per 100 000 population.
- Age-specific rates were highest in infants under one year of age (7.0 cases per 100 000 population for male, and 4.5 for female), followed by people aged 65 years and over (2.5 cases per 100 000 population for male, and 2.0 for female).
- Serotyping data were available for 58% of the confirmed cases. Of the known cases, non-capsulated strains were the most common among all age groups and caused 73% of the cases overall. Serotype f was the most common capsulated serotype observed (10%).
- In 2022, there was a slight increase in *H. influenzae* serotype b (Hib) which represented 9.1% (n=211) of cases compared to 7% (n=153) in 2018.

Introduction

Invasive *Haemophilus influenzae* is a bacterium that can cause serious 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, septicemia, pneumonia, and epiglottitis. *Haemophilus influenzae* remains the leading cause of meningitis deaths in unvaccinated people around the world [1].

Methods

This report is based on data for 2022 retrieved from The European Surveillance System (TESSy) on 2 February 2024. TESSy is a system for the collection, analysis, and dissemination of data on communicable diseases. 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' [3].

In 2022, 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 [3]. Belgium reported aggregated data.

Suggested citation: European Centre for Disease Prevention and Control (ECDC). *Haemophilus influenzae*. In: ECDC. Annual epidemiological report for 2022. Stockholm: ECDC; 2024.

Stockholm, July 2024

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Epidemiology

In 2022, 30 EU/EEA countries reported a total of 3 967 confirmed cases of invasive *H. influenzae* disease, an increase on the totals for 2021 (1 694) and 2020 (1 849) (Table 1). The overall notification rate for the EU/EEA was 0.9 cases per 100 000 population, marking a resurgence towards the pre-pandemic levels of 2018 and 2019, compared to the lower rates of 0.4 in both 2020 and 2021. Denmark and Iceland reported the highest notification rates at 2.0 and 2.1 cases per 100 000 population, respectively.

It is interesting to note that France, Germany, and Italy together accounted for 48% (1 904 case) of all confirmed cases while several countries, including Croatia, Cyprus, and Malta, reported very few or no cases.

Table 1. Distribution of confirmed *Haemophilus influenzae* disease cases and rates per 100 000 population by country and year, EU/EEA, 2018–2022

Country	2018		2019		2020		2021		2022	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Austria	49	0.6	64	0.7	28	0.3	31	0.3	77	0.9
Belgium	87	NRC	76	NRC	27	NRC	38	NRC	146	NRC
Bulgaria	1	0.0	3	0.0	0	0.0	0	0.0	1	0.0
Croatia	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0
Cyprus	0	0.0	0	0.0	0	0.0	1	0.1	3	0.3
Czechia	26	0.2	25	0.2	22	0.2	10	0.1	46	0.4
Denmark	121	2.1	115	2.0	59	1.0	101	1.7	117	2.0
Estonia	1	0.1	3	0.2	2	0.2	1	0.1	7	0.5
Finland	89	1.6	77	1.4	41	0.7	15	0.3	78	1.4
France	594	1.0	694	1.2	399	0.7	434	0.7	731	1.2
Germany	832	1.0	940	1.1	520	0.6	362	0.4	982	1.2
Greece	7	0.1	5	0.0	2	0.0	6	0.1	9	0.1
Hungary	32	0.3	24	0.2	10	0.1	15	0.2	40	0.4
Iceland	3	0.9	8	2.2	5	1.4	7	1.9	8	2.1
Ireland	59	1.2	63	1.3	31	0.6	16	0.3	65	1.3
Italy	169	0.3	185	0.3	76	0.1	66	0.1	191	0.3
Latvia	4	0.2	4	0.2	1	0.1	1	0.1	13	0.7
Liechtenstein	NDR	NRC	NDR	NRC	NDR	NRC	2	5.1	0	0.0
Lithuania	14	0.5	3	0.1	0	0.0	2	0.1	58	2.1
Luxembourg	0	0.0	0	0.0	3	0.5	3	0.5	10	1.5
Malta	0	0.0	3	0.6	0	0.0	0	0.0	0	0.0
Netherlands	237	1.4	227	1.3	203	1.2	166	0.9	320	1.8
Norway	91	1.7	98	1.8	40	0.7	58	1.1	133	2.5
Poland	115	0.3	102	0.3	78	0.2	52	0.1	145	0.4
Portugal	35	0.3	42	0.4	35	0.3	42	0.4	50	0.5
Romania	1	0.0	0	0.0	1	0.0	0	0.0	12	0.1
Slovakia	6	0.1	8	0.1	5	0.1	1	0.0	9	0.2
Slovenia	19	0.9	24	1.2	11	0.5	15	0.7	29	1.4
Spain	364	0.9	245	0.6	161	0.4	171	0.4	463	1.0
Sweden	201	2.0	259	2.5	89	0.9	78	0.8	224	2.1
EU/EEA (30 countries)	3 157	0.7	3 298	0.8	1 849	0.4	1 694	0.4	3 967	0.9
United Kingdom	835	1.3	NDR	NRC	NDR	NRC	NA	NA	NA	NA
EU/EEA (31 countries)	3 992	0.8	3 298	0.8	1 849	0.4	NA	NA	NA	NA

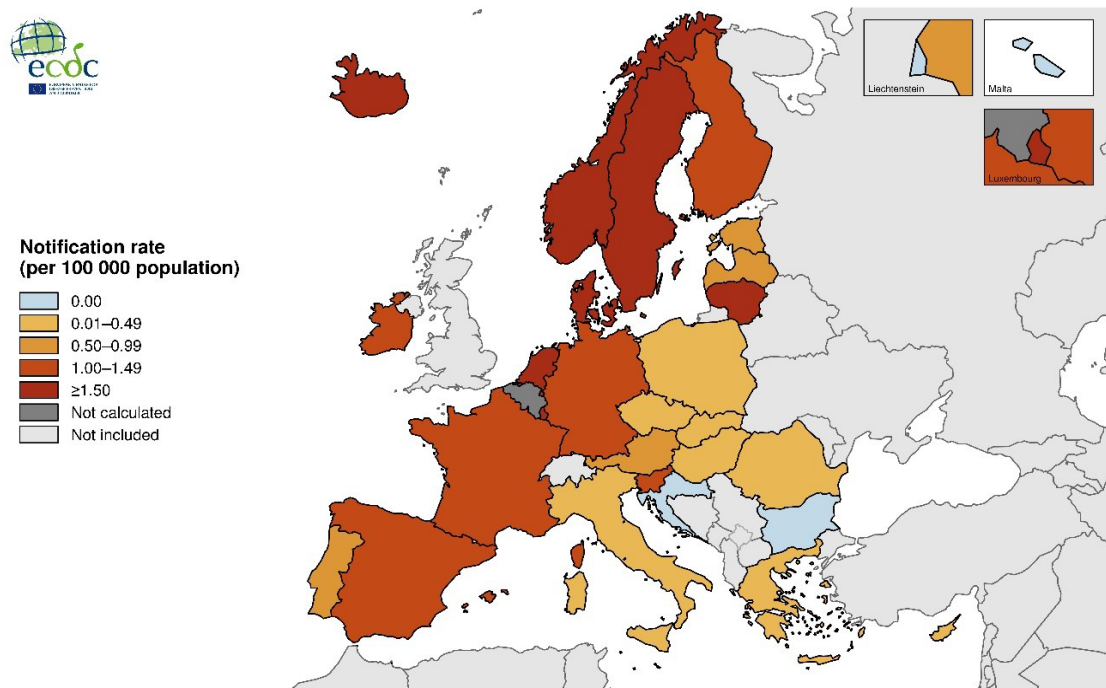
Source: Country reports.

NDR: No data reported.

NRC: No rate calculated.

NA: Not applicable.

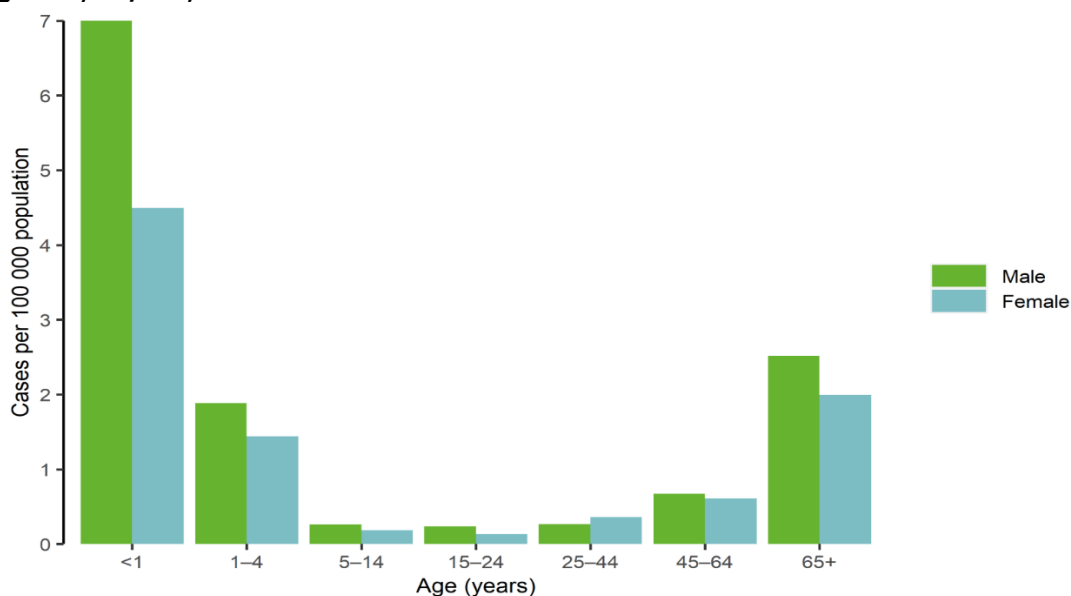
From 2020 onwards, no data were reported by the United Kingdom, due to its withdrawal from the EU on 31 January 2020.

Figure 1. Confirmed *Haemophilus influenzae* disease cases per 100 000 population by country, EU/EEA, 2022

Administrative boundaries: © EuroGeographics
The boundaries and names shown on this map do not imply official endorsement or acceptance by the European Union. ECDC. Map produced on 6 February 2024.

Age and gender distribution

In 2022, invasive *H. influenzae* disease showed a higher incidence in males across most age groups (with the exception of the 25–44 years age group), with the most pronounced difference observed in infants under one year. The age-specific notification rates were highest among the youngest age group, with a rate of 7.0 cases per 100 000 population for male infants under one year, and 4.5 for females. For adults aged 65 years and over, the rate was between 2.0 and 3.0 cases per 100 000 population, but slightly higher for males than females (2.5 and 2.0 respectively). The disparity between males and females was consistent across the age spectrum, with males generally showing higher notification rates. The overall trend indicated that the burden of disease is largest in the very young, with the elderly population being the second most affected group (Figure 2).

Figure 2. Confirmed *Haemophilus influenzae* disease cases per 100 000 population, by age and gender, EU/EEA, 2022

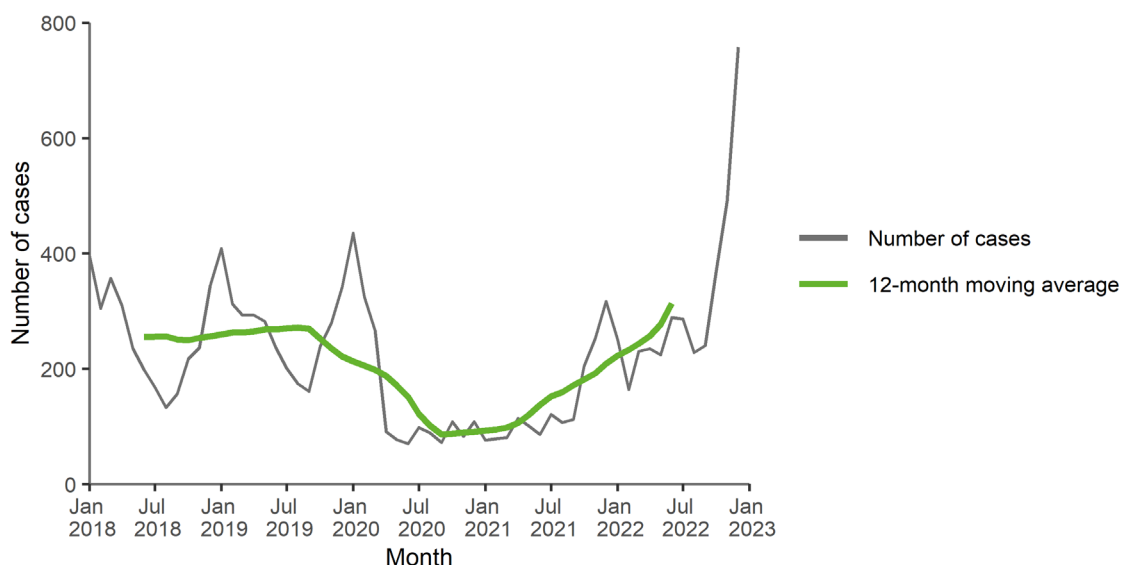
Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain,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

Seasonality and trend

Figure 3 indicates that the distribution of invasive *H. influenzae* cases by month typically shows a seasonal pattern, peaking in the winter months (as displayed in January 2020, January 2019 and January 2018). However, a noticeable decline in the number of cases was observed during the period corresponding to the COVID-19 pandemic (2020, 2021). This decline is consistent with the overall reduction in respiratory infections during the pandemic, probably due to the public health measures such as social distancing, mask-wearing, and lockdowns implemented globally [4]. The 12-month moving average line on the graph flattens considerably during this period, indicating a sustained decrease in cases. Post-pandemic, there was a sharp increase in the number of cases reported which surpasses previous years.

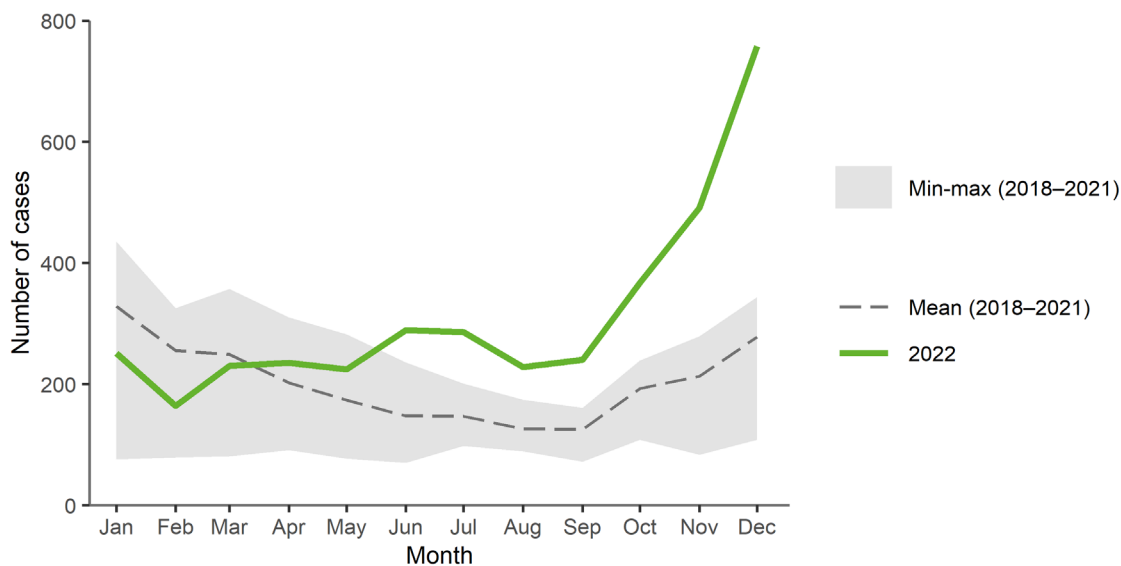
Figure 4 shows the number of cases in 2022 compared to the previous period 2018–2021. In 2022, the number of cases started below the historical average for *H. influenzae*, however, during the summer the number exceeded the average and then spiked beyond the maximums for the previous four years towards the end of the year.

Figure 3. Confirmed *Haemophilus influenzae* disease cases by month, EU/EEA, 2018–2022



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.

Figure 4. Confirmed *Haemophilus influenzae* disease cases by month, EU/EEA, 2022 and 2018–2021

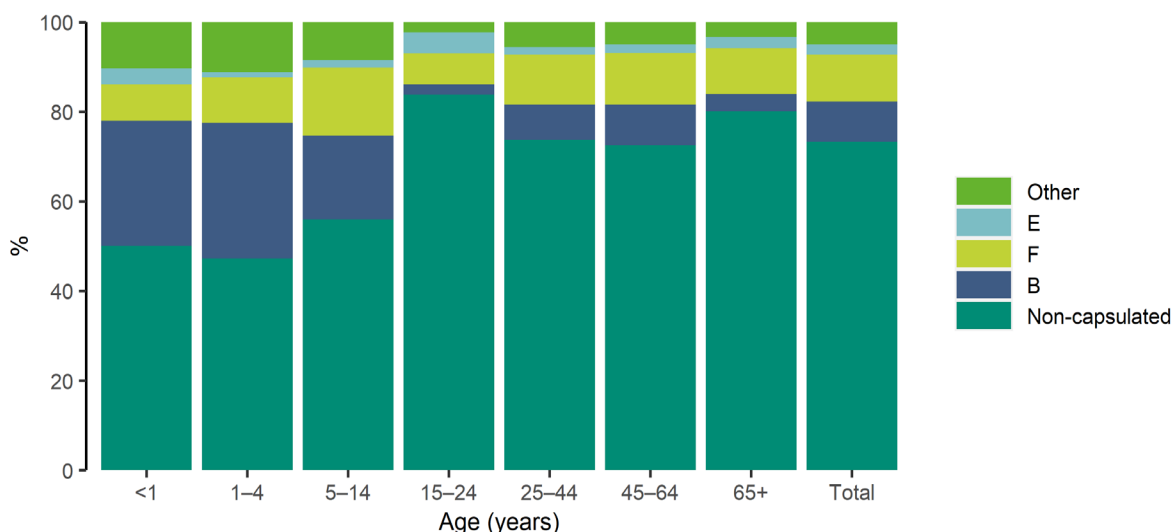


Source: Country reports from Austria, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

Serotype

In 2022, there were 2 307 cases of invasive *H. influenzae* disease with known serotype (58%). Of the known cases, the non-capsulated was the main type, with 1 685 cases (73%), Serotype b (Hib) was registered in 211 cases (9.1%) and was considerably more apparent among the youngest age groups, particularly in children under one year (38 cases), and children aged 1–4 years (54 cases). Serotype e and other serotypes together accounted for a smaller proportion of cases across all age groups (52 cases in total). Type f accounted for 10% of cases (243 cases), while other types accounted for 4%. (Figure 5).

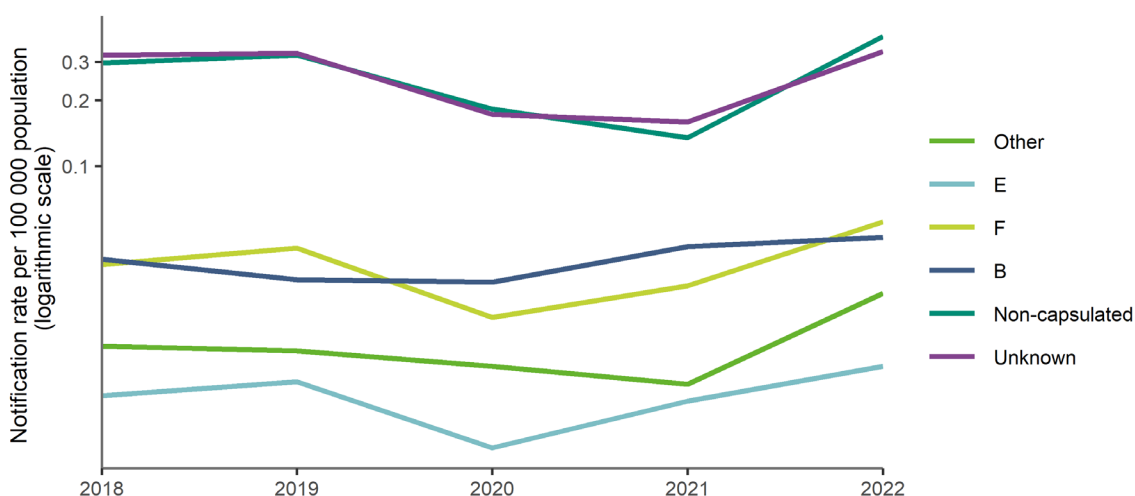
Figure 5. Serotype distribution of confirmed *Haemophilus influenzae* disease cases with known serotype by age group, EU/EEA, 2022



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

Figure 6 shows the notification rates per 100 000 population for different serotypes of invasive *H. influenzae* from 2018 to 2022. Among the different serotypes/groups of serotypes the rate for non-capsulated strains has been the highest for most of the years during the five-year period, peaking in 2022 (0.39). In 2022, serotype b had similar results to those for 2021 (0.05 and 0.04 respectively) but had increased slightly compared to 2019 (0.03). Although the rates for serotypes e and f have fluctuated, they have shown a general upward trend in recent years. The 'Other' serotypes category increased in 2022 (0.03) compared to previous years and similarly, in 2022 unknown serotype cases increased against the levels for 2021 (from 0.16 to 0.32).

Figure 6. Notification rate of confirmed *Haemophilus influenzae* disease per 100 000 population, by serotype and year, EU/EEA, 2018–2022



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

Clinical presentation

In 2022, of 3 967 confirmed cases of invasive *H. influenzae* disease, clinical presentations were known for 2 449 (61.8%). Pneumonia was the most reported clinical presentation, with 668 cases (16.84%). Septicaemia was identified in 395 cases (9.96%), while meningitis alone was reported in 259 cases (6.53%). A combination of meningitis with septicaemia was observed in 24 cases (0.60%). Less common conditions included cellulitis with seven cases (0.18%), epiglottitis with 29 cases (0.73%), and osteomyelitis/septic arthritis with 18 cases (0.45%). Other presentations accounted for 747 cases (18.83%). The clinical presentations were unknown for 1 518 cases (38.2%).

Outcome

The outcome was known for 1 944 cases (49%), while for 224 (5.6%) this was not under surveillance and for 1 799 (45.3%) the outcome was unknown. Of the known outcomes, the case fatality rate (CFR) was 9.2% (n=179), four deaths were reported in children under one year, and six in children aged 1–4 years.

When considering the outcome for cases with known serotype, 2022 data showed that the CFR was 13.79% for serotype e as there had been four deaths out of 29 cases with known outcome and serotype, and 11.76% for serotype a (four deaths out of 34 cases). For the non-capsulised cases, CFR was 9.5% (95 deaths out of 887 cases) and for serotype b the CFR was 6.43% (9 deaths out of 140 cases).

Vaccination status

In 2022, the vaccination status was known for 1 017 of the 3 967 confirmed cases (25%) of invasive *H. influenzae* disease. Among those with known vaccination status, 230 cases (22.6%) were vaccinated, and 787 cases (77.4%) were unvaccinated. The number of doses of vaccine received varied: 21 cases had received one dose, 21 had received two doses, 71 had received three doses and 43 had received four doses.

A total of 42 of the 250 (17%) cases aged under one year had been vaccinated, (33%), while 88 of 269 cases aged 1–4 years, and only 27 of 2 141 (1.2%) cases aged over 65 years had been vaccinated.

Discussion

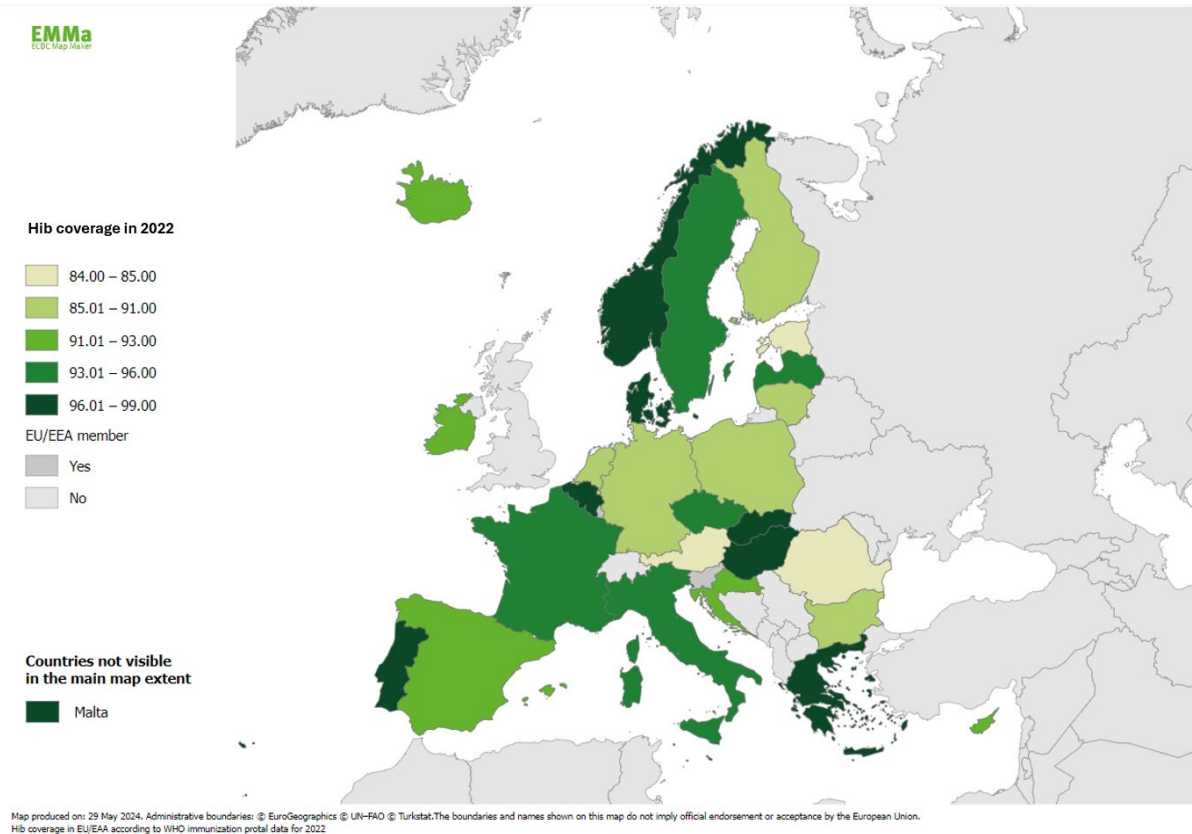
In 2022, the EU/EEA reported an increase in invasive *H. influenzae* disease, with 3 967 confirmed cases, representing a return to pre-pandemic incidence rates. This increase, compared to 1 694 cases in 2021 and 1 849 in 2020, corresponded with the lifting of COVID-19 public health measures. The removal of these restrictions probably reduced the indirect protection provided against various respiratory pathogens, including *H. influenzae*. [4, 5]. As in previous years, the clinical burden of *H. Influenzae* in 2022 remained highest among infants and the elderly, as the majority of cases were under one year, or over 65 years [6, 7]. Compared to previous years, the completeness of the data remained low in terms of clinical presentation, vaccination status, and case outcomes. Among the cases for which information was available in 2022, clinical presentations varied, with pneumonia and septicaemia the most frequently reported, which corresponds to previous reports [6, 7] and with regard to vaccination status, 77% of cases had not received any doses of vaccine.

The notification rates for non-capsulated strains of *H. influenzae* increased in 2022, while serotype b cases showed a slight increase compared to 2018. An analysis of the serotype trend over the years in the EU/EEA shows a decrease in type b, a pattern which can be directly attributed to the successful introduction of routine Hib vaccination as part of national vaccination programmes in the EU/EEA countries [8, 9].

The World Health Organization recommends the inclusion of conjugate Hib vaccines in all infant immunisation programmes, offering either three primary doses without a booster or two-to-three primary doses with a booster, depending on the age-specific disease burden [10]. This strategy has led to a significant decrease in both invasive Hib disease and pharyngeal Hib carriage, thus facilitating herd protection and highlighting the success of Hib vaccination as a crucial public health intervention [10]. In the European region, the average vaccination coverage in 2022 for Hib was (93%), which represents an increase on the coverage recorded in 2021 for Hib (81%) [11]. Figure 9 represents third dose vaccination coverage for Hib in the EU/EEA.

Historically, before the advent of Hib vaccines, invasive *H. influenzae* disease primarily involved serotype b infections among healthy young children [12]. The implementation of Hib vaccination in the EU/EEA has reduced the incidence of invasive Hib disease across all age groups, with the most substantial declines observed in young children [13-16]. The majority of current Hib cases are now seen in older adults with underlying co-morbidities [15]. Since 2010, Hib vaccination has been integrated into the national immunisation programmes across all EU/EEA Member States, achieving high coverage and maintaining a sustained low number of reported Hib cases in all age groups [8]. The 2022 data showed that serotype b also had a lower case fatality rate than other serotypes, which shows a shift from the historical trends. The same results have also been presented in previously published literature that has found a continuing decrease in Hib case incidence and fatality [17, 18]. Serotype f has emerged as the most prevalent capsulated serotype in Europe, representing 9% of all cases reported in 2017 [7] and 10% of the cases in 2022. Following the widespread introduction of vaccination, the global reduction in Hib disease represents a significant public health success [13]. However, the increase in non-capsulated *H. influenzae* disease and other serotypes in the post-Hib vaccine era necessitates continued attention. Maintaining high immunisation coverage is essential to continue protecting against Hib, particularly with the rising incidence of non-capsulated strains and the vulnerability of certain age groups and individuals with pre-existing health conditions. The effectiveness of public health interventions, as evidenced during the COVID-19 pandemic, plays a vital role in controlling the spread of infectious diseases such as *H. influenzae*, demonstrating the broader impact of such measures beyond their immediate target diseases and the complex interplay between vaccination strategies and disease surveillance in shaping public health policies [19].

The COVID-19 pandemic had a significant impact on the incidence and management of *Haemophilus influenzae* infections, indicating complex interactions between pandemic measures and the transmission of other respiratory pathogens. During the pandemic, widespread implementation of public health measures such as social distancing, mask-wearing, and lockdowns was inadvertently associated with reduced transmission of various respiratory infections, including *H. influenzae*. As these measures were relaxed, the EU/EEA, like many other regions, witnessed a resurgence in cases of invasive *H. influenzae*, suggesting a reversion to pre-pandemic levels of 2018 and 2019 [6]. This rebound underscores the dual role of public health interventions in controlling COVID-19 and inadvertently affecting the dynamics of other infectious diseases. The COVID-19 era has therefore emphasised the need for robust infectious disease surveillance and adaptable public health strategies to manage the broader spectrum of respiratory pathogens alongside emerging viruses, such as SARS-CoV-2.

Figure 9. Vaccination coverage of third dose of Hib-containing vaccine, EU/EEA

Data source: WHO immunisation portal, 2022

Public health implications

The number of *H. influenzae* cases in the EU/EEA has seen an uptick compared to 2020 and 2021, which is largely attributable to the relaxation of public health measures implemented during the COVID-19 pandemic. Despite this increase, the current case numbers only slightly exceed those seen before the pandemic.

The sustained success of Hib vaccination programmes is evident. Maintaining high vaccination coverage in young children across Europe is essential to ensure the protection of all age groups against Hib.

References

1. European Centre for Disease Prevention and Control (ECDC). Factsheet - Invasive *Haemophilus influenzae* disease. Stockholm: ECDC; 2024. Available at: [Invasive *Haemophilus influenzae* disease \(europa.eu\)](https://www.ecdc.europa.eu/en/publications-data/surveillance-systems-overview-2022)
2. European Centre for Disease Prevention and Control (ECDC). Surveillance systems overview for 2022. Available at: <https://www.ecdc.europa.eu/en/publications-data/surveillance-systems-overview-2022>
3. European Centre for Disease Prevention and Control (ECDC). Surveillance atlas of infectious diseases. 2024. Available at: <http://atlas.ecdc.europa.eu/public/index.aspx?Dataset=27&HealthTopic=22>
4. Brueggemann AB, Jansen van Rensburg MJ, Shaw D, McCarthy ND, Jolley KA, Maiden MCJ, et al. Changes in the incidence of invasive disease due to *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Neisseria meningitidis* during the COVID-19 pandemic in 26 countries and territories in the Invasive Respiratory Infection Surveillance Initiative: a prospective analysis of surveillance data. *The Lancet Digital Health*. 2021;3(6):e360-e70.
5. Lan C, Chen YC, Chang YI, Chuang PC. Impact of COVID-19 Outbreak on Influenza and Pneumococcal Vaccination Uptake: A Multi-Center Retrospective Study. *Vaccines (Basel)*. 2023;11(5).
6. European Centre for Disease Prevention and Control (ECDC). *Haemophilus influenzae* - Annual Epidemiological Report for 2018. ECDC: Stockholm; 2020. Available at: <https://www.ecdc.europa.eu/en/publications-data/haemophilus-influenzae-annual-epidemiological-report-2018>
7. European Centre for Disease Prevention and Control (ECDC). *Haemophilus influenzae* - Annual Epidemiological Report for 2017. Stockholm: ECDC; 2019. Available from: <https://www.ecdc.europa.eu/sites/default/files/documents/haemophilus-influenzae-annual-epidemiological-report-2017.pdf>
8. Whittaker R, Economopoulou A, Dias JG, Bancroft E, Ramliden M, Celentano LP. Epidemiology of Invasive *Haemophilus influenzae* Disease, Europe, 2007-2014. *Emerg Infect Dis*. 2017;23(3):396-404.
9. Desai S, Jamieson FB, Patel SN, Seo CY, Dang V, Fediurek J, et al. The Epidemiology of Invasive *Haemophilus influenzae* Non-Serotype B Disease in Ontario, Canada from 2004 to 2013. *PLoS One*. 2015;10(11):e0142179.
10. World Health Organization (WHO). WHO position paper on *Haemophilus influenzae* type b (Hib) vaccination. *Weekly Epidemiol Rec WHO*: 2013;88:413-28.
11. World Health Organization (WHO). Global Vaccination coverage trendline. Immunization dashboard. WHO: 2022. Available at: <https://immunizationdata.who.int/>
12. Peltola H. *Haemophilus influenzae* type b disease and vaccination in Europe: lessons learned. *Pediatr Infect Dis J*. 1998;17(9 Suppl):S126-32.
13. Georges S, Lepoutre A, Dabernat H, Levy-Bruhl D. Impact of *Haemophilus influenzae* type b vaccination on the incidence of invasive *Haemophilus influenzae* disease in France, 15 years after its introduction. *Epidemiol Infect*. 2013;141(9):1787-96.
14. Kastrin T, Paragi M, Kolman J, Cizman M, Kraigher A, Gubina M. Characterisation of invasive *Haemophilus influenzae* isolates in Slovenia, 1993-2008. *Eur J Clin Microbiol Infect Dis*. 2010;29(6):661-8.
15. Collins S, Ramsay M, Campbell H, Slack MPE, Ladhani SN. Invasive *Haemophilus influenzae* Type b Disease in England and Wales: Who Is at Risk After 2 Decades of Routine Childhood Vaccination? *Clinical Infectious Diseases*. 2013;57(12):1715-21.
16. Monge S, Mollema L, de Melker H, Sanders E, van der Ende A, Knol M. Clinical Characterization of Invasive Disease Caused by *Haemophilus influenzae* Serotype b in a High Vaccination Coverage Setting. *J Pediatric Infect Dis Soc*. 2019;8(3):261-4.
17. Gilsdorf JR. Hib Vaccines: Their Impact on *Haemophilus influenzae* Type b Disease. *J Infect Dis*. 2021;224(12 Suppl 2):S321-s30.
18. Reilly AS, McElligott M, Mac Dermott Casement C, Drew RJ. *Haemophilus influenzae* type f in the post-*Haemophilus influenzae* type b vaccination era: a systematic review. *J Med Microbiol*. 2022;71(10).
19. Toor J, Echeverria-Londono S, Li X, Abbas K, Carter ED, Clapham HE, et al. Lives saved with vaccination for 10 pathogens across 112 countries in a pre-COVID-19 world. *Elife*. 2021;10.