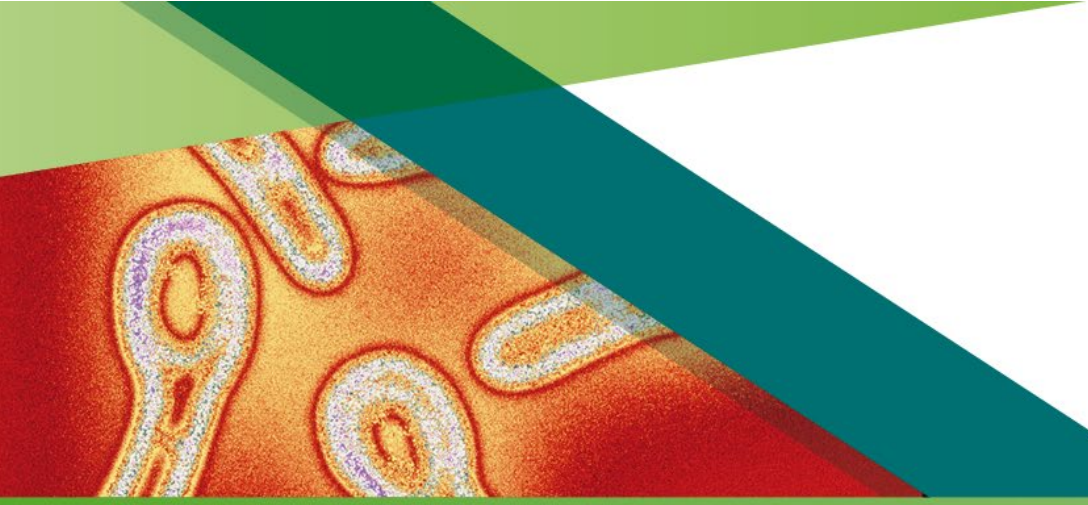

SURVEILLANCE REPORT

Diphtheria

Annual Epidemiological Report for 2023

Key facts

- In 2023, 216 cases of diphtheria due to toxigenic *Corynebacterium diphtheriae* (n=155) or *C. ulcerans* (n=61) were reported to ECDC.
- The increase of diphtheria among migrants reported in several EU/EEA countries in the second half of 2022 decreased to lower levels in 2023.
- The highest proportion of *C. diphtheriae* cases was among 15- to 24-year-old males. *C. ulcerans* cases were more common in adults aged 45 years and above.
- Among *C. diphtheriae* cases with importation status available, 34% were reported as imported (having been outside the country of notification during the incubation period with no links to local transmission), with 78% of the imported cases presenting with a cutaneous infection.
- Vaccination status was available for 44% of all cases. Sixty-seven percent of the cases with known vaccination status were not vaccinated or were vaccinated with an unknown number of doses.
- Vaccination with the diphtheria toxoid vaccine is the only effective method of preventing the toxin-mediated disease. Achieving and sustaining high vaccination coverage in the population is critical for preventing toxigenic diphtheria from causing serious or fatal illness.

Introduction

Diphtheria is a bacterial infectious disease, which can be prevented by vaccination. Humans are the only known significant reservoir for *C. diphtheriae* [1]. Transmission occurs via airborne respiratory droplets, direct contact with respiratory secretions, indirect contact with exudate from infected cutaneous lesions or with contaminated surfaces [2]. The incubation period ranges from two to five days, but can be as long as 10 days [1].

Following an infection, unvaccinated individuals may present with skin infections (cutaneous diphtheria), classical respiratory diphtheria and in rare cases, systemic diphtheria [3]. Case fatality of respiratory diphtheria can be as high as 5-10% [4]. In highly vaccinated populations, most infections are asymptomatic or have a mild clinical course. Such cases are rarely diagnosed and reported unless detected during active case finding or contact tracing. The most common sites from which bacteria are isolated in symptomatic as well as asymptomatic infections are the pharynx, larynx, tonsils, nose, and skin. Other rare sites of involvement include the mucous membranes of the conjunctiva and vulvovaginal area, as well as the external auditory canal [1]. The critical diphtheria virulence factor is the production of an exotoxin (called diphtheria toxin). The toxin kills tissue cells at the site of infection and produces systemic effects including myocarditis, nephritis, polyneuropathy, and paralysis when disseminated via the bloodstream.

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Stockholm, January 2026

The other potentially toxigenic two Corynebacteria species, *C. ulcerans* and (very rarely) *C. pseudotuberculosis*, may also cause diphtheria disease. These infections are in the vast majority zoonotic, with human-to-human transmission almost never reported [2]. The diphtheria toxin secreted by the two species is 95% homologous to that of *C. diphtheriae* and the biological effect and clinical presentation of *C. ulcerans* and *C. pseudotuberculosis* are similar to that caused by the diphtheria toxin produced by *C. diphtheriae* [2,5].

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 that replaced The European Surveillance System (TESSy) in October 2024.

An overview of the national surveillance systems is available online [6].

Following an increase of diphtheria cases in 2022, ECDC updated its reporting mechanism for diphtheria to monitor any ongoing outbreaks. All diphtheria cases should be reported to EpiPulse Cases on a monthly basis; they are published in the interactive 'Surveillance atlas of infectious diseases' on a monthly basis [7]. An annual data call, including zero reporting, is also carried out to analyse the data for the respective Annual Epidemiological Report.

In 2023, 29 European Union/European Economic Area (EU/EEA) countries reported data on diphtheria and related toxigenic pathogens. Of these, 15 countries reported cases of *Corynebacterium diphtheriae* or *C. ulcerans.*

Most countries reported data on diphtheria according to the 2008 (n=6), 2012 (n=7) or 2018 (n=12) EU case definition. Five countries used an alternative case definition. Regardless of the case definition used, only cases caused by or with a clinical syndrome consistent with toxigenic strains should be reported at the EU level [8].

All countries reported data from a comprehensive and compulsory case-based surveillance system [6].

Epidemiology

In 2023, 215 cases of laboratory-confirmed diphtheria and related toxigenic pathogens, one possible case and one probable case of diphtheria were reported (Table 1, Figure 1). Some 154 confirmed cases and one probable case were reported as *C. diphtheriae*, 61 confirmed cases were reported as *C. ulcerans*, and for one possible case the pathogen was unknown (Table 2). The overall notification rate was 0.01 per 100 000 population.

Diphtheria caused by *C. diphtheriae* was reported by 14 countries (Table 2). Among these countries, Germany (n=95) and France (n=18) reported the highest number of cases, followed by the Netherlands (n=13).

Diphtheria caused by *C. ulcerans* was reported by 12 countries. More than 65% of these cases were reported in Germany (n=22) and in France (n=19).

Between 2019 and 2023, 754 cases of diphtheria were reported in the EU/EEA (Table 1), of which 563 cases were due to *C. diphtheriae*.

Table 1. Diphtheria cases by country and year, EU/EEA, 2019–2023

Country	2019	2020	2021	2022	2023
	Number		Number		Number
Austria	0	2	2	62	4
Belgium	6	3	4	31	14
Bulgaria	0	0	0	0	0
Croatia	0	0	0	0	0
Cyprus	0	0	0	0	0
Czechia	0	0	0	5	7
Denmark	0	0	1	0	NDR
Estonia	0	0	0	0	0
Finland	0	0	0	0	0
France	19	18	22	60	37
Germany	15	24	22	171	117
Greece	1	0	0	0	0
Hungary	0	0	0	0	0
Iceland	0	0	0	0	0
Ireland	0	0	0	0	0
Italy	0	0	0	3	3
Latvia	3	0	0	0	3
Liechtenstein	NDR	NDR	0	0	0
Lithuania	0	0	0	0	0
Luxembourg	0	0	1	0	2
Malta	0	0	0	0	0
Netherlands	0	3	0	6	14
Norway	2	0	0	8	4
Poland	0	0	0	0	1
Portugal	0	0	0	0	0
Romania	0	0	0	0	0
Slovakia	2	0	4	8	2
Slovenia	0	0	0	0	4
Spain	2	1	1	1	2
Sweden	4	0	4	4	3
EU/EEA (30 countries)	**54**	**51**	**61**	**359**	**217**
United Kingdom	12	NDR	NA	NA	NA
EU/EEA (31 countries)	**66**	**51**	**NA**	**NA**	**NA**

Source: country reports; ASR: age-standardised rate; 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. Diphtheria cases by country, EU/EEA, 2023

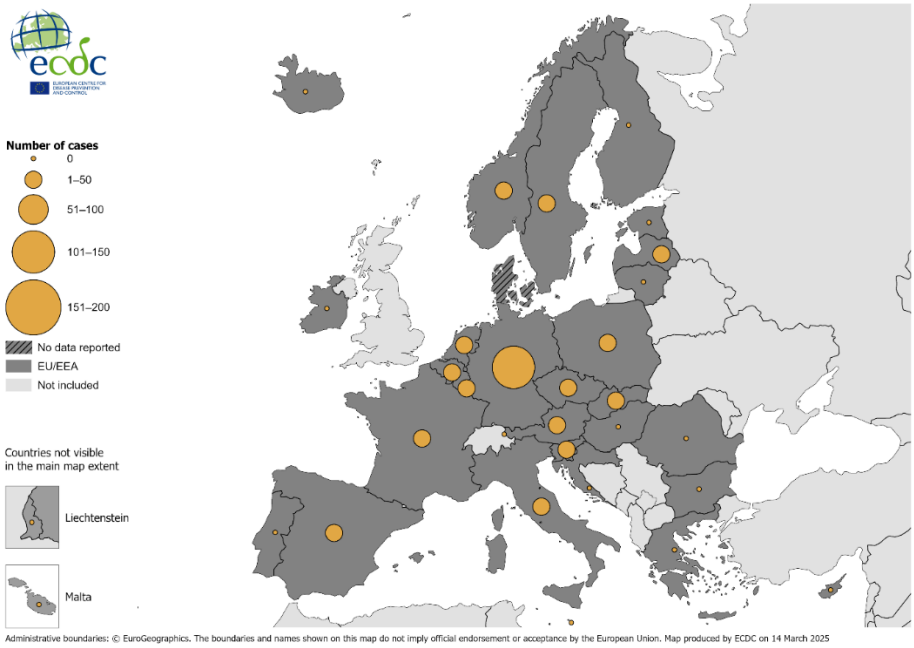


Table 2. Number of reported cases of diphtheria by country and species, EU/EEA, 2023

Country	*C. diphtheriae*	*C. ulcerans*
Austria	3	1
Belgium	9	5
Bulgaria	0	0
Croatia	0	0
Cyprus	0	0
Czechia	2	5
Denmark	NDR	NDR
Estonia	0	0
Finland	0	0
France	18	19
Germany	95	22
Greece	0	0
Hungary	0	0
Iceland	0	0
Ireland	0	0
Italy	2	0
Latvia	2	1
Liechtenstein	0	0
Lithuania	0	0
Luxembourg	1	1
Malta	0	0
Netherlands	13	1
Norway	2	2
Poland	0	1
Portugal	0	0
Romania	0	0
Slovakia	2	0
Slovenia	4	0
Spain	1	1
Sweden	1	2
Total	**155**	**61**

Source: Country reports from Austria, Belgium, Czechia, France, Germany, Italy, Latvia, Luxembourg, the Netherlands, Norway, Poland, Slovakia, Slovenia, Spain, and Sweden. One additional case with unknown pathogen was reported from Italy.

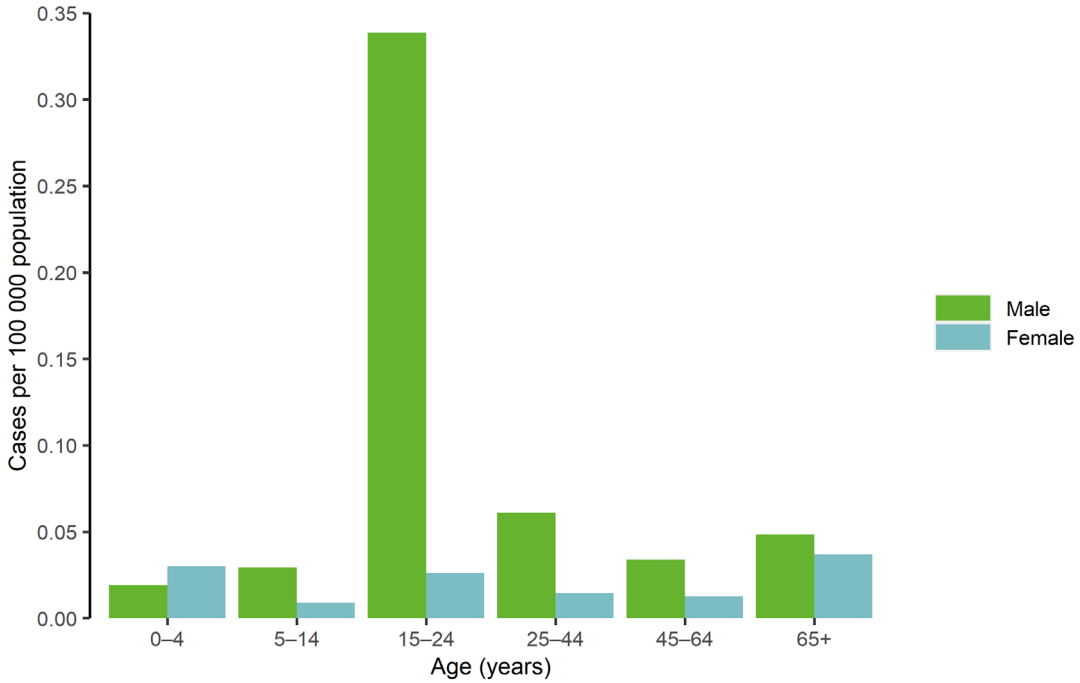
Age and gender distribution

In 2023, cases were reported among all age groups, with a preponderance among those aged 15–24 years (42%) (Figure 2). Of all cases reported, 168 (77%) were males.

Of the 155 *C. diphtheriae* cases, 12 (8%) were below 15 years, 88 (57%) were reported in teenagers and young adults from 15–24 years, and 55 (35%) were reported in adults 25 years and over (Figure 3). Of the 153 cases with known gender, 135 (88%) were reported in males.

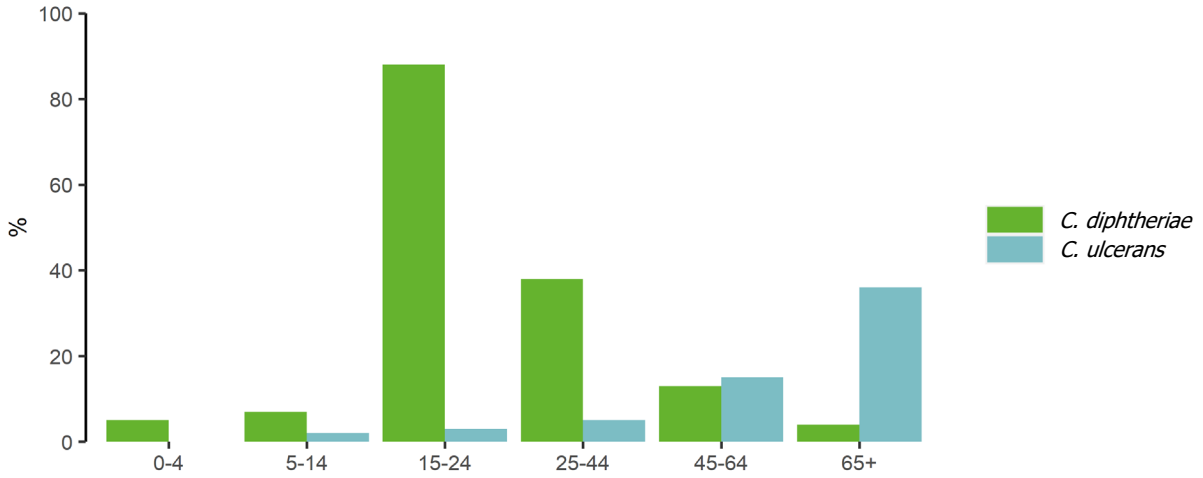
Of the 61 *C. ulcerans* cases, 10 (16%) were reported in individuals younger than 44 years, and 51 (84%) cases were reported in adults 45 years and over (Figure 3). Thirty-three (54%) of the *C. ulcerans* cases were reported in males.

Figure 2. Diphtheria cases per 100 000 population, by age and gender, EU/EEA, 2023



Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, 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.

Figure 3. **Age distribution of diphtheria cases by species, EU/EEA, 2023**

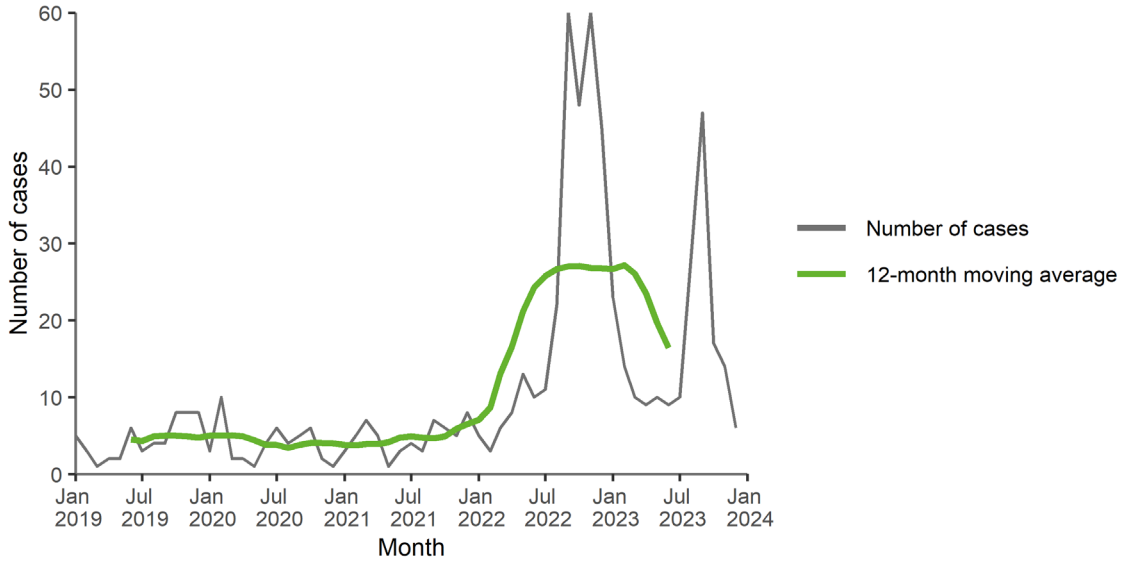


Source: Country reports from Austria, Belgium, Czechia, France, Germany, Italy, Latvia, Luxembourg, the Netherlands, Norway, Poland, Slovakia, Slovenia, Spain and Sweden.

Seasonality

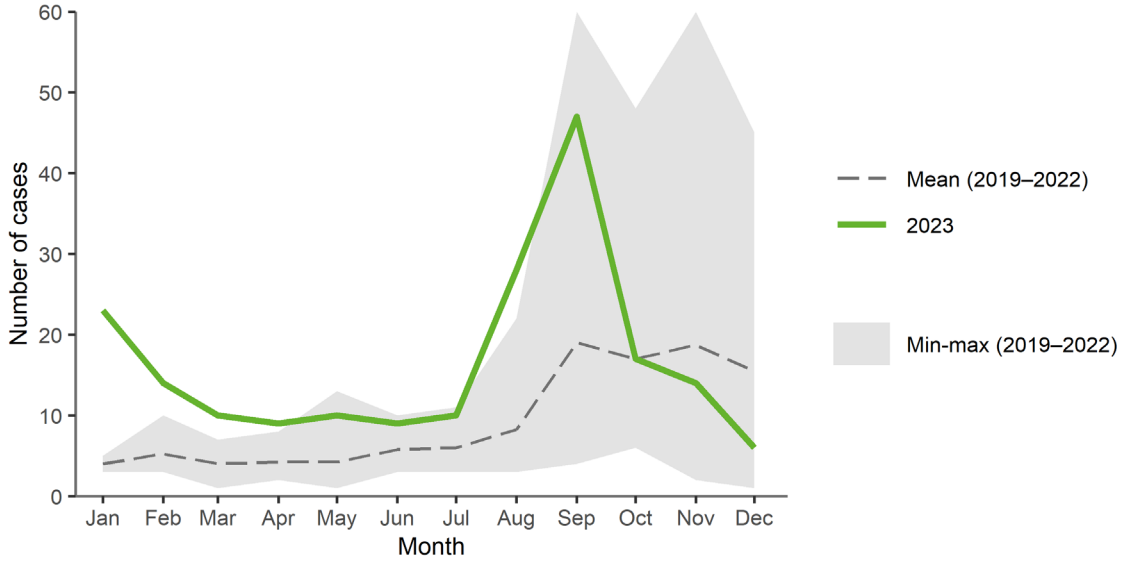
The low number of cases reported does not allow for analysis of seasonal variation (Figure 4). While in previous years cases were reported throughout the year and peaked during the last quarter, in 2022 an increase of cases was reported starting in summer, leading to a major increase of cases in the second half of the year, with case numbers peaking in September to December compared to the first half of the year (Figure 5). A similar pattern with a peak in the second half of the year, although with lower case numbers than in 2022, was reported in 2023.

Figure 4. **Diphtheria cases by month, EU/EEA, 2019–2023**



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

Figure 5. Diphtheria cases by month, EU/EEA, 2023 and 2019–2022



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

Clinical presentation, biotype and outcome

Some 135 *C. diphtheriae* cases were reported with known clinical presentation. Five of these cases (3.7%) were reported as classical respiratory diphtheria, by Belgium (2), Austria (1), Latvia (1) and the Netherlands (1). Seven cases (5.2%) were reported as respiratory infection without membrane, by Germany (5), Belgium (1) and Latvia (1). The Netherlands reported two cases (1.5%) with a respiratory and cutaneous infection. Germany (90), the Netherlands (10), Belgium (4), Slovenia (4), Czechia (2), Italy (2). Norway (2), Austria (1), Slovakia (1), Spain (1) and Sweden (1) reported 118 *C. diphtheriae* cases (87%) with cutaneous infections. Belgium reported one case (0.8%) with nasal infection, and Austria (1) and Slovakia (1) reported two cases (1.5%) with 'other' clinical presentation. France (18), Belgium (1) and Luxembourg (1) reported 20 cases with unknown clinical presentation.

For 41 of the *C. ulcerans* cases, clinical presentation was reported as known. Thirty-five of these cases (85%) had cutaneous infection. These were reported from Germany (21), Belgium (4), Czechia (3), Sweden (2), Austria (1), the Netherlands (1), Latvia (1), Norway (1) and Spain (1). Poland reported one case (2.4%) with classical respiratory infection, and Belgium (1), Czechia (1) and Germany (1) reported three cases (7.3%) as respiratory infection without membrane. Czechia reported one case (2.4%) with nasal infection and Norway reported one case (2.4%) with 'other' clinical presentation. Twenty cases with unknown clinical presentation were reported from France (19) and Luxembourg (1).

Seven *C. diphtheriae* cases were due to biotype Var gravis and four *C. diphtheriae* cases were due to biotype Var mitis. For 144 *C. diphtheriae* cases, the biotype was unknown, and it was not available for all 61 *C. ulcerans* cases.

Information on eventual outcome was available for 183 cases. Four deaths were reported: two deaths due to *C. diphtheriae* in Belgium (1) and France (1) and two deaths due to *C. ulcerans* in France (1) and Germany (1). Clinical presentation of the two deaths due to *C. diphtheriae* was reported as classical respiratory diphtheria. The deaths due to *C. ulcerans* presented with cutaneous infection (1) and unknown clinical presentation (1). The vaccination status for the two deaths due to *C. diphtheriae* was unknown for one case, while the other case was not vaccinated. The vaccination status for the two deaths due to *C. ulcerans* was unknown for one case while the other case was vaccinated with an unknown number of doses.

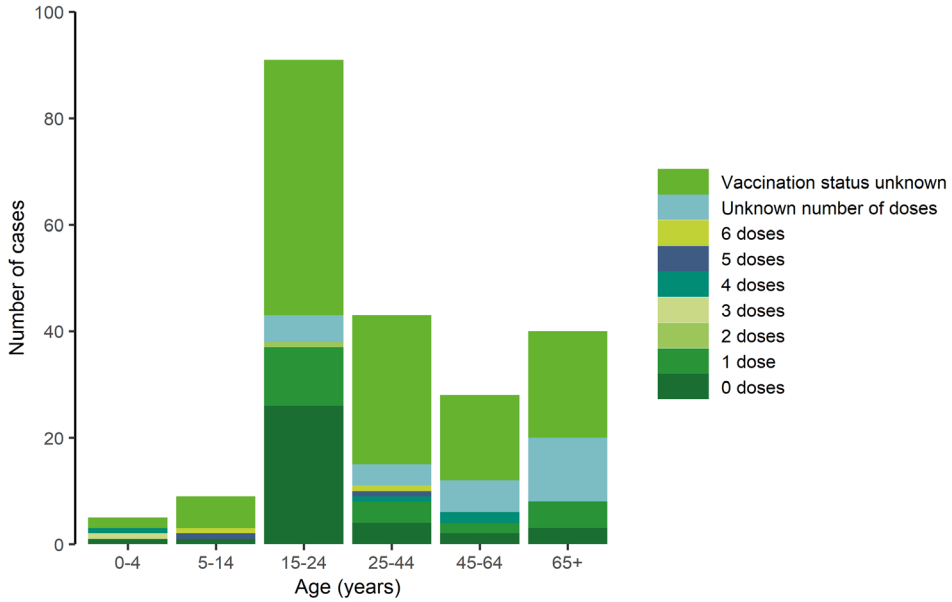
Vaccination status

Vaccination status was available for 68 *C. diphtheriae* cases. Twenty-two of these (32%) were reported to have been vaccinated with a known number of doses: 15 (22%) received one dose, one (1.5%) received two doses, one (1.5%) received three doses, two (2.9%) received four doses, two (2.9%) received five doses and one (1.5%) received six doses (Figure 6). Thirteen *C. diphtheriae* cases (19%) were vaccinated with an unknown number of doses and 33 cases (49%) were not vaccinated.

For 28 *C. ulcerans* cases, vaccination status was available. Ten *C. ulcerans* cases (36%) were reported to have been vaccinated with a known number of doses: seven (25%) received one dose, two (7.1%) received four doses, and one (3.6%) received six doses. Fourteen C. *ulcerans* cases (50%) were reported as vaccinated with an unknown number of doses and four *C. ulcerans* cases (14%) were reported as not vaccinated at all.

The vaccination status was unknown for 87 *C. diphtheriae* and 33 *C. ulcerans* cases.

Figure 6. Number of cases of diphtheria by vaccination status and age group, EU/EEA countries, 2023



Source: Country reports from Austria, Belgium, Czechia, France, Germany, Italy, Latvia, Luxembourg, the Netherlands, Norway, Poland, Slovakia, Slovenia, Spain, and Sweden.

Importation status

Importation status was available for 210 cases, and of these 71 cases (34%) were reported as imported cases. An imported case is defined as a case having been outside the country of notification during the incubation period of the reported disease, and no links to local transmission has been identified. Sixty-nine of the imported cases were caused by *C. diphtheriae*, and two imported cases were due to *C. ulcerans*. Fifty-four (78%) of the imported cases caused by *C. diphtheriae* presented with cutaneous disease, while one case (1.5%) presented with respiratory and cutaneous infection and clinical presentation was unknown for 14 cases (20%). Of the two imported cases caused by *C. ulcerans*, one case presented with cutaneous presentation and clinical presentation was unknown for one case.

The probable country of origin was known for 48 cases (68%) caused by *C. diphtheriae*. They were imported from Afghanistan (25), Syria (11), Philippines (2) Türkiye (2), Eritrea (1), Ethiopia (1), Indonesia (1), Iraq (1), Pakistan (1), Sudan (1), Slovenia (1) and Thailand (1). The two imported cases caused by *C. ulcerans* were imported from Croatia (1) and Sudan (1).

Nine cases (4.3%) were reported as import-related cases. An import-related case is defined as a case epidemiologically linked to an imported case, i.e. cases that acquired the infection locally through a direct link to an imported case in the first chain (only) of transmission as supported by epidemiological and/or virological evidence.

All imported-related cases were caused by *C. diphtheriae.* One of these cases was import-related from Syria, while the probable country of infection was unknown for eight cases.

Cluster-relatedness, whole genome sequencing and antibiotic susceptibility testing

Following the increase of diphtheria cases in 2022 and the updated reporting mechanism, ECDC introduced new metadata for diphtheria including variables to identify if a case is part of an outbreak or a cluster, information on whole genome sequencing and information on antibiotic susceptibility testing.

In 2023, information on cluster-relatedness was available for 36 cases. Twelve cases (33%) were reported as being related to a cluster, while 24 cases (66%) were not related to a cluster. Further details, including information on cluster setting (setting where a cluster-related case has been identified), whole genome sequencing and antibiotic susceptibility testing results, cannot be described due to limited reporting of these variables.

Discussion

This report includes cases due to *C. diphtheriae* and *C. ulcerans*. While all countries had surveillance in place for *C. diphtheriae*, few countries reported cases to ECDC from 2019–2023. It is likely that countries with reported cases of all species causing diphtheria in consecutive years have a higher awareness of these pathogens [9].

Diphtheria case detection is strongly influenced by the availability of laboratory resources, expertise and surveillance systems [10,11]. This varies across Europe, and in the past few countries have performed toxigenicity testing [10-12]. Therefore, under-ascertainment and under-reporting are possible.

The majority of *C. diphtheriae* cases with known clinical presentation were reported as cutaneous, with unknown vaccination status, unvaccinated or one dose only of vaccination; the fatalities reported were in individuals with a respiratory presentation and either with an unknown vaccination status or unvaccinated. Most imported *C. diphtheriae* cases with known probable country of infection were imported from endemic geographical areas. The number of susceptible individuals in the EU, such as travellers and migrant populations, are likely to have contributed to distribution [13,14]. European travellers may become infected and develop cutaneous diphtheria while travelling or working in endemic countries. ECDC data presented in this report show that most cutaneous cases had an uncertain vaccination status or were unvaccinated. Unvaccinated individuals exposed to overcrowding and poor hygiene conditions are at risk for acquiring diphtheria and transmitting the infection. The vaccination status of travellers to diphtheria-endemic areas should be checked, and catch-up or booster doses should be offered and made accessible at any relevant opportunity. Furthermore, ensuring equitable access to vaccination for migrants is essential, considering the specific challenges faced by such populations in accessing the healthcare system. Vaccination of individuals in the EU should be kept up to date, including necessary boosters in adult and older age groups, on the basis of national vaccine recommendations [3,14-17].

The substantial increase of cutaneous diphtheria among migrants in EU/EEA countries starting in the second half of 2022 which prompted an ECDC risk assessment and increased monitoring through event based and indicator-based surveillance decreased to lower levels in 2023 [14,18]. Nevertheless, as of June 2025, additional cases of sequence types detected in 2022 have continued to circulate in different populations, prompting ECDC to update the 2022 risk assessment [19,20].

Communication with countries experiencing diphtheria cases suggest that a significant effort is required for the clinical and public health management of cases for a disease rarely seen in Europe.

The European Commission has appointed a European Reference Laboratory to support the control and monitoring of pertussis and diphtheria in the EU/EEA countries: the European Reference Laboratory for Public Health in Diphtheria and Pertussis (EURL-PH-DIPE) [21]. The EURL-PH-DIPE aims to maintain and increase the EU/EEA's capacity to respond to the health threats posed by diphtheria and pertussis. This will be accomplished by developing and harmonising laboratory capacity in EU/EEA countries; improving surveillance, harmonising methods, providing expertise to ECDC and to a network of national reference centres; training in diagnostics, antimicrobial susceptibility testing and genomic sequence data analysis; and ensuring a rapid response to local and larger-scale outbreaks.

Public health implications

Vaccination with the diphtheria toxoid vaccine is the only effective method of preventing the toxin-mediated disease. Achieving and sustaining high vaccination coverage in the population is critical for preventing toxigenic diphtheria from causing serious or fatal illness. In addition, special attention should be given to travellers and migrants arriving from endemic countries, as well as healthcare and social workers.

If cases occur, prompt clinical recognition, laboratory confirmation and treatment are essential, including rapid investigation and management of close contacts of cases. The rapid administration of diphtheria antitoxin (DAT), according to national or local guidelines, is required for the successful treatment of respiratory diphtheria, in combination with antibiotic treatment, and may also be required for other forms of diphtheria. When used, DAT should be administered upon clinical suspicion of diphtheria, whether or not symptoms of systemic toxicity are present. The timely mobilisation of available DAT stocks in individual countries should therefore be ensured.

References

1. Acosta AM, Moro PL, Hariri S, Tiwari TSP. The Epidemiology and Prevention of Vaccine-Preventable Diseases - The Pink Book: Diphtheria. Atlanta: CDC; 2024. Available at: https://www.cdc.gov/pinkbook/hcp/table-of-contents/chapter-7-diphtheria.html?CDC_AAref_Val=https://www.cdc.gov/vaccines/pubs/pinkbook/dip.html
2. Bennett JE, Dolin R, Blaser M, (editors). Mandell, Douglas and Bennett's Principles and Practice of Infectious Diseases. Philadelphia: Elsevier Saunders; 2015. Available at: https://www.sciencedirect.com/book/9781455748013/mandell-douglas-and-bennetts-principles-and-practice-of-infectious-diseases
3. World Health Organization (WHO). Diphtheria vaccine: WHO position paper August 2017. Weekly Epidemiological Record. 2017; 92(31). Available at: http://apps.who.int/iris/bitstream/handle/10665/258681/WER9231.pdf;jsessionid=991993BDEDFEB6
4. Tiwari TSP. Control of Communicable Diseases Manual: Diphtheria. 2024. In: Heymann DL, editor. Washington DC: American Public Health Association. 21. Available at: https://ccdm.aphapublications.org/doi/10.2105/CCDM.2745.055
5. Pappenheimer AM, Murphy JR. Studies on the molecular epidemiology of diphtheria. Lancet. 1983; 2(8356):[923-6 pp.]. Available at: https://www.sciencedirect.com/science/article/pii/S014067368390449X?via%3Dihub
6. European Centre for Disease Prevention and Control (ECDC). Surveillance systems overview 2023. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/Table-surveillance_systems_overview_2023-v2.xlsx
7. European Centre for Disease Prevention and Control (ECDC). Surveillance Atlas of Infectious Diseases. Stockholm: ECDC; 2025. Available at: https://atlas.ecdc.europa.eu
8. European Commission (EC). Commission Implementing Decision 2012/506/EU of 8 August 2012 amending Decision No 2119/98/EC of the European Parliament and of the Council (notified under document C(2012) 5538) – (Text with EEA relevance) – (2012/506/EU) Off J Eur Union 1-57]. Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:262:0001:0057:EN:PDF
9. European Centre for Disease Prevention and Control (ECDC). Rapid Risk Assessment: A case of diphtheria in Spain. Stockholm: ECDC; 2015. Available at: https://www.ecdc.europa.eu/sites/default/files/media/en/publications/Publications/diphtheria-spain-rapid-risk-assessment-june-2015.pdf
10. European Centre for Disease Prevention and Control (ECDC). Gap analysis on securing diphtheria diagnostic capacity and diphtheria antitoxin availability in the EU/EEA. Stockholm: ECDC; 2017. Available at: https://www.ecdc.europa.eu/en/publications-data/gap-analysis-securing-diphtheria-diagnostic-capacity-and-diphtheria-antitoxin
11. Both L, Neal S, De Zoysa A, Mann G, Czumbel I, Efstratiou A, et al. External Quality Assessments for Microbiologic Diagnosis of Diphtheria in Europe. J Clin Microbiol. 2014 December;52(12):4381-4.
12. Wagner KS, White JM, Lucenko I, Mercer D, Crowcroft NS, Neal S, et al. Diphtheria in the Postepidemic Period, Europe, 2000–2009. Emerg Infect Dis. 2012 Feb;18(2):217-25.
13. European Centre for Disease Prevention and Control (ECDC). Rapid Risk Assessment: Cutaneous diphtheria among recently arrived refugees and asylumseekers in the EU. Stockholm: ECDC; 2015. Available at: https://www.ecdc.europa.eu/sites/default/files/media/en/publications/Publications/Diphtheria-cutaneous-EU-July-2015.pdf
14. European Centre for Disease Prevention and Control (ECDC). Rapid Risk Assessment: Increase of reported diphtheria cases due to Corynebacterium diphtheriae among migrants in Europe. Stockholm: ECDC; 2022. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/diphtheria-cases-migrants-europe-corynebacterium-diphtheriae-2022.pdf
15. Jablonka A, Behrens GMN, Stange M, Dopfer C, Grote U, Hansen G, et al. Tetanus and diphtheria immunity in refugees in Europe in 2015. Infection. 2017 April;45(2):157-64.
16. Liang JL, Tiwari T, Moro P, Messonnier NE, Reingold A, Sawyer M, et al. Prevention of Pertussis, Tetanus, and Diphtheria with Vaccines in the United States: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep. 2018 April;67(2):1-44.
17. Hargreaves S, Nellums LB, Ravensbergen SJ, Friedland JS, Stienstra Y, Migrants EWGoVi. Divergent approaches in the vaccination of recently arrived migrants to Europe: a survey of national experts from 32 countries, 2017. Euro Surveillance. 2018 October;23(41):1700772.
18. European Centre for Disease Prevention and Control (ECDC). Weekly Bulletin – Communicable Disease Threats Report, Week 41, 8–14 October 2023. Stockholm: ECDC. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/communicable-disease-threats-report-week-41-2023.pdf
19. European Centre for Disease Prevention and Control (ECDC). Weekly Bulletin – Communicable Disease Threats Report, Week 20, 10-16 May 2025. Stockholm: ECDC. Available at: https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-10-16-may-2025-week-20
20. European Centre for Disease Prevention and Control (ECDC). Rapid Risk Assessment: Diphtheria caused by Corynebacterium diphtheriae ST574 in the EU/EEA, 2025. Stockholm: ECDC; 2025. Available at: https://www.ecdc.europa.eu/en/publications-data/rapid-risk-assessment-diphtheria-caused-corynebacterium-diphtheriae-st574-eueea
21. European Commission (EC). EU Reference Laboratories for public health. Available at: https://health.ec.europa.eu/health-security-and-infectious-diseases/surveillance-and-early-warning/eu-reference-laboratories-public-health_en