

# epiTRENDS

A Monthly Bulletin on Epidemiology and Public Health Practice in Washington  
**August 2023 Volume 28, Number 8**

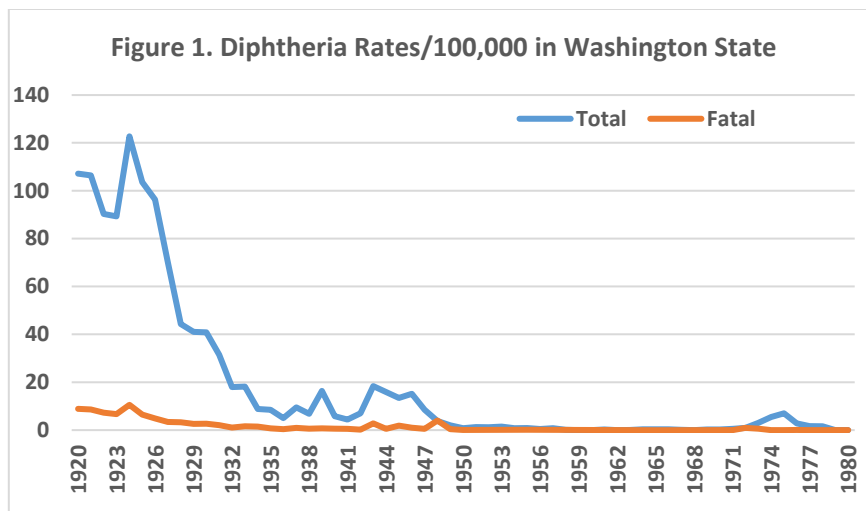
## **Diphtheria and Non-toxigenic *C. diphtheriae* Infections in Washington**

While diphtheria may seem to be a disease from remote times, it remains a global challenge and even raises concerns in the United States. This country has only rare cases of diphtheria reported, but related conditions continue to occur.

### **The Disease Diphtheria**

The disease diphtheria is defined as an infection with **toxigenic** *Corynebacterium diphtheriae* at any anatomic site. Most infections involve the pharynx and tonsils but if the larynx becomes infected there can be fatal airway obstruction. Strains of the organism not producing toxin can cause infections but are not counted as diphtheria. Case classification is primarily based on toxigenicity testing.

Data from a hundred years ago shows Washington diphtheria case rates as high as 123 per 100,000 population with deaths almost every year. Diphtheria vaccine use began in 1914, but disease rates did not fall for another decade. Rates have been minimal since the 1950s. The last case of toxigenic diphtheria reported in Washington was in 1979.



Scott Lindquist, MD, MPH  
State Epidemiologist,  
Communicable Disease

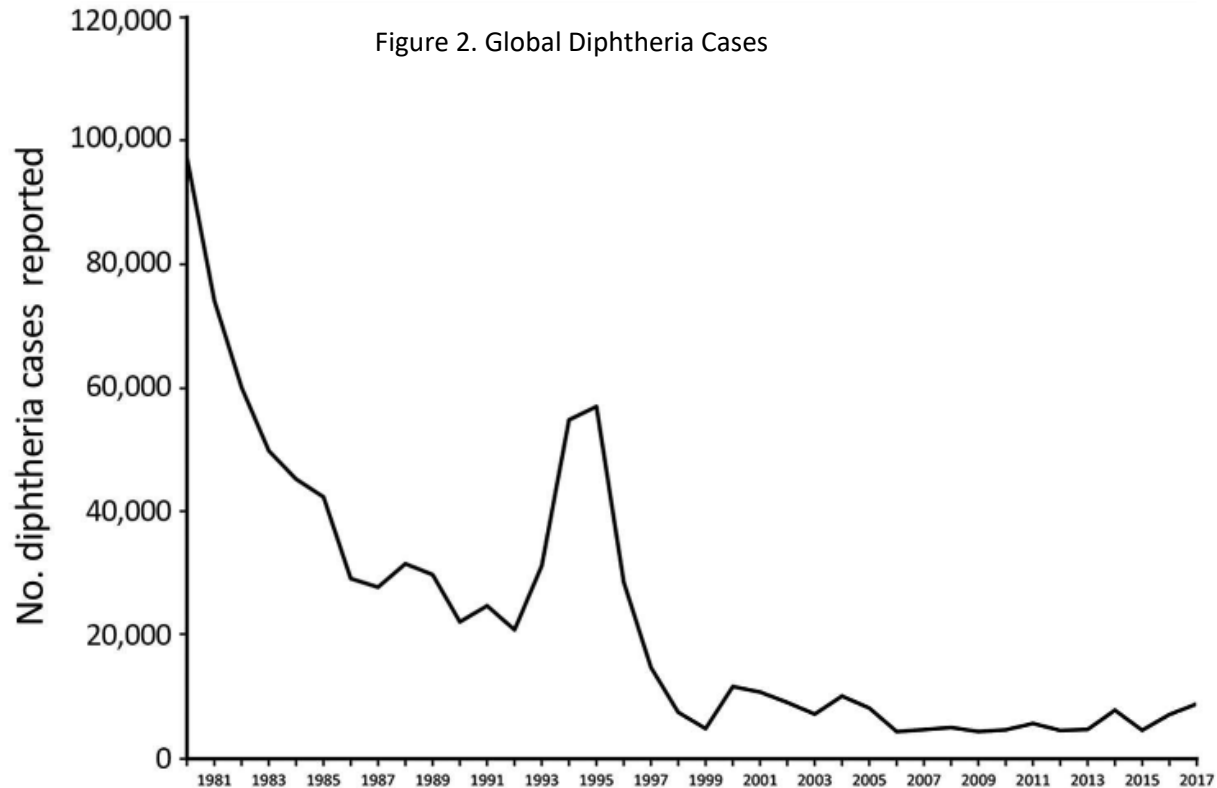
Marcia J. Goldoft, MD  
Scientific Editor

You may subscribe, update subscription preferences, or unsubscribe to [epiTRENDS at Department of Health website.](#)

To request this document in another format, call 1-800-525-0127. Deaf or hard of hearing customers, please call 711 (Washington Relay) or email [civil.rights@doh.wa.gov](mailto:civil.rights@doh.wa.gov)

### Burden of Diphtheria Globally

Over the past 25 years, considerable progress has been made worldwide in controlling diphtheria. Through 2017 reported cases worldwide had dropped 90% from 1980.



[Global Epidemiology of Diphtheria, 2000–2017 - PMC \(nih.gov\)](#) #

However, diphtheria cases continue to occur singly and in small clusters due to under-vaccination and waning immunity. Global interruptions in vaccination programs during the COVID-19 response have resulted in vulnerable pediatric populations in countries where diphtheria persists. In 2017, Washington State was home to a traveler who returned from the Philippines with a toxigenic cutaneous diphtheria infection, reported in [this MMWR](#) (also see Resources).

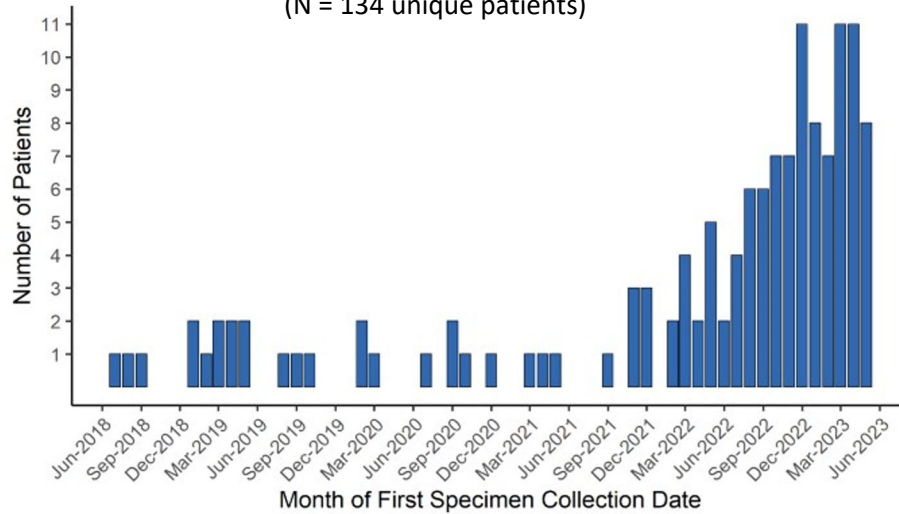
Recently there have been diphtheria outbreaks in Pakistan with 45 pediatric deaths in 2022, in the Philippines with ten deaths compared to zero deaths the prior year, and in Nigeria beginning in May with 80 deaths by July 2023. Diphtheria cases were also reported in Europe associated with immigration.

### Non-toxigenic *C. diphtheriae* infections

Infections with non-toxigenic *C. diphtheriae* can result in slow-healing cutaneous ulcers, bacteremia, septic arthritis, and even respiratory infections. Non-toxigenic infections are not counted as cases of diphtheria, and are not vaccine-preventable, as the diphtheria toxoid vaccine only protects against diphtheria toxin. Non-toxigenic infections with *C. diphtheriae*, particularly cutaneous disease but sometimes invasive infections, are an emerging issue in the United States.

In Washington State, from July 1, 2018 through June 1, 2023, 134 unique patients were reported with at least one specimen testing positive for *C. diphtheriae*, with a larger increase beginning in late 2021; there are no signs of a decreasing trend at this time.

Fig. 3 Epidemiologic Curve by Month of First Specimen Collection Date July 1, 2018 – June 1, 2023 (N = 134 unique patients)



Toxigenicity testing at CDC showed that all isolates were non-toxicogenic. While 80% of patients had cutaneous or wound isolates, 17% of patients had invasive infections with *C. diphtheriae* found in blood or joint fluid. Some patients with invasive infections had severe disease including bacterial endocarditis, which was fatal for at least two patients.

Additionally, 97% of all patients resided in Western Washington, and 60% of patients were currently experiencing homelessness or were known to have previously experienced homelessness at the time of specimen collection, with 28% of patients having stable housing (and 13% missing or unknown). Substance use was also common, with 50% of patients reporting substance use or heavy alcohol consumption, even though this information is missing or unknown for 42% of patients. Whole genome sequencing for *C. diphtheriae* is being onboarded at the Washington State Public Health Laboratories, and bioinformatics and molecular epidemiology capacity are also being strengthened, so further investigations can be done through sequencing.

**Conclusion**

Currently, non-toxicogenic *C. diphtheriae* infections are being reported at a very high level compared to pre-2021 activity. Further investigations into the epidemiology of non-toxicogenic infections are being considered.

The possibility for a toxigenic strain to be imported also remains a threat in Washington State, particularly for unvaccinated or under-vaccinated international travelers. Toxigenicity testing is currently done on all reported *C. diphtheriae* isolates to ensure we do not miss any diphtheria cases. Disease investigators can gain insight into the risk of a positive *C. diphtheriae* test representing a toxigenic infection by assessing the case’s clinical presentation, vaccination status, travel history, and recent contact with people with diphtheria-like disease. Always forward isolates or specimens associated with a positive result to the Department of Health for confirmation.

## Resources

Global epidemiology of diphtheria: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6759252/>

Imported toxin-producing cutaneous diphtheria:  
<https://www.cdc.gov/mmwr/volumes/68/wr/mm6812a2.htm>

Cutaneous diphtheria genomic epidemiology, King County:  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8116682/>

Historical reports for cutaneous diphtheria in Seattle:  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1432014/>  
<https://www.acpjournals.org/doi/abs/10.7326/0003-4819-111-1-71>  
<https://academic.oup.com/jid/article-abstract/159/4/670/797640>

