

# PUBLIC HEALTH REFERENCE SHEET

## Diphtheria



|                                      |   |
|--------------------------------------|---|
| <b>Name</b>                          | <i>Corynebacterium diphtheria</i>   |
| <b>Reservoir &amp; Transmission</b>  | - Humans<br>- Person-to-person contact  |
| <b>Incubation Period</b>             | Usually 2–5 days, (range 1–10 days)   |
| <b>Common Symptoms</b>               | Weakness, sore throat, fever, adenitis in the neck, and adherent membrane lesions in the nose, pharynx, larynx, or on the tonsils |
| <b>Gold Standard Diagnostic Test</b> | Culture   |
| <b>Risk Groups</b>                   | Non-immunized or under-immunized children younger than 15 years   |
| <b>Geographic Significance</b>       | Present worldwide, particularly tropical areas, less common in vaccinated countries   |

### What is diphtheria?

Diphtheria is an acute, bacterial disease caused by toxin-producing strains of *Corynebacterium diphtheria*, an aerobic gram-positive bacillus. This disease primarily manifests as respiratory infections that may result in death, but it may also present as mild infections in non-respiratory sites, such as skin infections. A case of diphtheria may present as:

- **Respiratory:** Upper respiratory tract illness with an adherent membrane of the nose, pharynx, tonsils, or larynx; or
- **Non-respiratory:** Infection of a non-respiratory anatomical site (e.g., skin, wound, conjunctiva, ear, genital mucosa)

### How is diphtheria transmitted?

Diphtheria is transmitted from person-to-person, usually through respiratory droplets, from coughing or sneezing. Rarely, transmission may occur from skin lesions (e.g., an abnormal sore) or clothes that are contaminated with discharges from lesions of an infected person.

### Who is at risk for diphtheria?

Once a widespread fatal childhood disease, diphtheria cases decreased due to vaccination. Respiratory diphtheria is uncommon in the United States. People at increased risk of getting sick include individuals in the same household or with a history of frequent, close contact with the patient, or directly exposed to secretions from the suspected infection site (e.g., mouth, skin) of the patient.

### What are the signs and symptoms of diphtheria?

The incubation period of diphtheria is usually 2–5 days (range: 1–10 days).

A case of diphtheria may present as:

- **Respiratory:** Upper respiratory tract illness with an adherent membrane of the nose, pharynx, tonsils, or larynx. When the bacteria that cause diphtheria invade the respiratory system, they produce a poison (toxin) that can cause weakness, sore throat, mild fever, malaise, and swollen glands in the neck. Within 2 to 3 days, a thick gray coating called a "pseudomembrane" can amass over the nasal tissues; tonsils; voice box; and throat, which makes it very hard to breathe and swallow. The toxin may be absorbed into the blood stream and may cause damage to the heart, kidneys, and nerves.
- **Cutaneous:** Infection of a non-respiratory anatomical site (e.g., skin, wound, conjunctiva, ear, genital mucosa). Cutaneous diphtheria may present as a scaling rash or ulcers with

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clearly demarcated edges and membrane; however, any chronic skin lesion may harbor *C. diphtheriae* along with other organisms. The systemic complications from cutaneous diphtheria with toxigenic strains appear to be less than from other sites.

### What are potential complications from diphtheria?

Most complications of respiratory diphtheria, including death, are attributable to effects of the toxin. The most frequent complications of respiratory diphtheria are myocarditis and neuritis. Other complications include otitis media and respiratory insufficiency due to airway obstruction, especially in infants. The overall case-fatality rate for diphtheria is 5%–10%, with higher death rates (up to 20%) among persons younger than 5 and older than 40 years of age.

Cutaneous diphtheria infection rarely results in severe disease.

### How is diphtheria diagnosed?

Diagnosis of respiratory diphtheria is usually made based on clinical presentation. Then, it is confirmed by isolating *C. diphtheriae* and testing the isolate for toxin production by the Elek test, which is an in vitro immunoprecipitation (immunodiffusion) assay. Other tests, such as polymerase chain reaction (PCR) and matrix assisted laser desorption/ionization-time of flight mass spectrometry (MALDI-TOF), may identify *C. diphtheriae*. However, when used alone, these tests do not confirm toxin production and are considered supplemental.

Specimens for culture should be obtained from the nostrils and oropharynx, or any mucosal or cutaneous lesion. If possible, material should be obtained from beneath the membrane (if present) or a portion of the membrane itself. Specimens are more likely to be culture-positive if obtained before the patient receives antibiotic treatment.

### How is diphtheria treated?

It is imperative to begin presumptive therapy quickly. After the provisional clinical diagnosis is made, obtain appropriate clinical specimens, start antibiotic treatment, and contact the state health department and CDC regarding antitoxin for respiratory diphtheria.

The recommended antibiotics for respiratory or cutaneous diphtheria are either erythromycin or penicillin. Even though disease is usually not contagious 48 hours after antibiotic treatment begins, maintain droplet precautions until the diphtheria patient has completed the antibiotic course and is culture negative. Document elimination of the organism by obtaining two consecutive negative cultures 24 hours apart, once antibiotic therapy is completed.

Treatment of cutaneous diphtheria with antibiotics is usually sufficient, and antitoxin is typically not needed. Contact precautions are recommended for cutaneous disease, until elimination of the organism is documented by obtaining two consecutive negative cultures 24 hours apart, once antibiotic therapy is completed.

The Food and Drug Administration has not licensed diphtheria antitoxin (DAT) for use in the United States. However, the CDC is authorized to distribute DAT to treating clinicians as an investigational new drug (IND).

Diphtheria disease might not confer immunity. Persons recovering from diphtheria should begin or complete vaccination with diphtheria toxoid during convalescence if not up-to-date with vaccination.

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### How can diphtheria be prevented?

Combination vaccines (diphtheria toxoid, tetanus toxoid, and acellular pertussis) used to prevent diphtheria include DTaP, Tdap, and Td. Each of these vaccines prevents diphtheria and tetanus. DTaP and Tdap vaccines also prevent pertussis (whooping cough). DTaP vaccines are given to children younger than 7 years of age. Tdap and Td vaccines are given to older children, teens, and adults. Service members are required to stay current on this vaccine, but other adults may not be current or may have never had an adult Tdap dose.

Toxoids in vaccines are inactivated (rendered harmless) bacterial toxins. Toxoids retain the ability to stimulate the body's formation of antitoxins against the bacterial toxins but does not provide any protection (antibodies) against the bacteria itself.

In 2023, following an interruption in the distribution of TDVAX, the CDC issued temporary guidance on using Tdap vaccine in lieu of Td vaccine. <https://www.cdc.gov/vaccines/vpd/dtap-tdap-td/hcp/recommendations.html#tdap-td>

In 2023, Sanofi Pasteur, Inc. stopped manufacturing the diphtheria and tetanus toxoids absorbed vaccine, commonly known as DT. Check with the CDC for updated vaccine recommendations for infants and children who should not receive acellular pertussis-containing vaccines. <https://www.cdc.gov/diphtheria/clinicians.html>

### What are some public health considerations?

- Document relevant travel and deployment history occurring within the incubation period.
- Note the patient's diphtheria immunization history.
- Document if the case patient works in, lives in, or attends a high transmission setting, such as daycare, school, group living, or health care.
- A patient without evidence of clinical symptoms, as described above, is not considered a reportable case, despite a confirmatory lab test for toxin-producing *C. diphtheriae*.
- Management of close contacts should include monitoring for possible respiratory or cutaneous diphtheria for 7 to 10 days from the time of the last exposure to the diphtheria patient and obtaining nasal and throat cultures for *C. diphtheriae*.

### References:

Defense Health Agency. 2022. *Armed Forces Reportable Medical Events: Guidelines and Case Definitions*.

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Heymann, David L. ed. 2022. *Control of Communicable Diseases Manual*. 21st Edition. Washington, DC: APHA Press.

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