

# Diphtheria

## Surveillance Protocol

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### Provider Responsibilities

1. Immediately:
  - a. Isolate a patient with suspected diphtheria using:
    - i. Droplet precautions for respiratory diphtheria; and
    - ii. Contact precautions for cutaneous diphtheria.
  - b. Notify the infection preventionist immediately if the patient is being sent to the hospital.
  - c. Antitoxin must be given within 48 hours to minimize cardiac and neurological complications. Notify the local health department or DIDE immediately at (304) 558-5358, extension 1 (or (304) 925-9946) to obtain antitoxin from CDC.
2. Manage as follows:
  - a. Penicillin or erythromycin should be prescribed for 14 days.
  - b. Antitoxin should be administered according to guidance from CDC as soon as feasible.
  - c. Age-appropriate vaccination for diphtheria should be administered during convalescence.
  - d. Two cultures taken 24 hours apart should be taken after completion of therapy to document eradication of the organism.
3. Be prepared to support public health investigation. Anticipate that local health department will need:
  - a. Clinical and laboratory data to confirm or rule out the case;
  - b. Vaccination history;
  - c. A list of contacts in the household, community and in healthcare settings.

### Laboratory Responsibilities

1. Report laboratory evidence of *Corynebacterium diphtheriae* or *ulcerans* immediately to the local health department or DIDE at (304) 558-5358, extension 1 (or (304) 925-9946).
2. Reserve the isolate for further characterization at CDC and contact the Office of Laboratory Services at (304) 558-3530 for information on shipping.

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### **Division of Infectious Disease Epidemiology**

350 Capitol Street, Room 125, Charleston, WV 25301-3715

Phone: (304) 558-5358, extension 1 Fax: (304) 558-6335 [www.dide.wv.gov](http://www.dide.wv.gov)

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### Local Health Responsibilities

1. Protect occupational health. Responders who will interview a potentially infectious patient should:
  - a. Have current Tdap vaccination; and
  - b. Use:
    - i. Droplet precautions (surgical mask) for respiratory diphtheria; and
    - ii. Contact precautions for cutaneous diphtheria.
2. Report suspected or confirmed cases of diphtheria immediately to DIDE so that antitoxin can be obtained.
3. Assure the case is managed properly in order to stop transmission. The case should:
  - a. Be isolated using droplet (respiratory diphtheria) or contact (cutaneous diphtheria) precautions.
  - b. Be treated with erythromycin orally or parenterally for 14 days, aqueous penicillin G administered intravenously for 14 days, or penicillin G procaine administered intramuscularly for 14 days (2015 Redbook).
  - c. Be cultured for diphtheria using two cultures 24 hours apart, 24 hours after completion of antibiotics to establish that carriage has been eliminated.
  - d. Receive age-appropriate vaccination during convalescence.
4. Interview the case using the WVEDSS form and submit promptly.
5. Obtain a line list of contacts.
  - a. Contacts are defined as:
    - i. Household members,
    - ii. People who have had direct close contact (including kissing or sexual contacts),
    - iii. Health care personnel exposed to nasopharyngeal secretions,
    - iv. People sharing utensils or kitchen facilities, and
    - v. People caring for infected children.
  - b. Line list all contacts or use the paper WVEDSS surveillance form at:  
<http://www.dhhr.wv.gov/oeps/disease/WVEDSS/Documents/Diphtheria.pdf>
  - c. Manage contacts as follows:
    - i. Assess for signs and symptoms. Symptomatic persons should be managed as cases.
    - ii. Culture all contacts

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1. Culture-positive asymptomatic contacts should be vaccinated immediately.
  - a. After treatment, two cultures should be obtained 24 hours apart to assure that carriage has been eradicated.
  - b. People who remain positive should receive an additional 10-day course of penicillin or erythromycin followed by repeat cultures to assure that eradication has occurred.
- iii. Assure prophylaxis with oral erythromycin (40-50 mg/kg per day for 7 to 10 days, maximum 1 g/day) or a single intramuscular injection of penicillin G benzathine (600 000 U for children weighing less than 30 kg, and 1.2 million U for children weighing 30 kg or more and adults) (2015 Redbook).
- iv. Assure that all contacts are brought up-to-date on vaccinations during the convalescent period.
- v. Place contacts under surveillance for 7 days. Refer to medical evaluation immediately for new onset of symptoms.

### **State Health Responsibilities**

1. Protect occupational health. Responders who will interview a potentially infectious patient should:
  - a. Have current Tdap vaccination; and
  - b. Use:
    - i. Droplet precautions (surgical mask) for respiratory diphtheria; and
    - ii. Contact precautions for cutaneous diphtheria.
2. Notify CDC Emergency Operations Center immediately when a suspect or confirmed case of diphtheria is reported.
3. Maintain capability to support emergency investigation including field investigation in support of local health efforts.

### **Disease Control Objectives**

- When a case of diphtheria is reported:
  - Isolate and treat the case to prevent spread

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### Disease Prevention Objectives

- Maintain high childhood and adult vaccination rates with DTaP / Tdap to prevent resurgence of diphtheria.

### Disease Surveillance Objectives

- To detect cases or outbreaks of diphtheria if they occur in West Virginia.

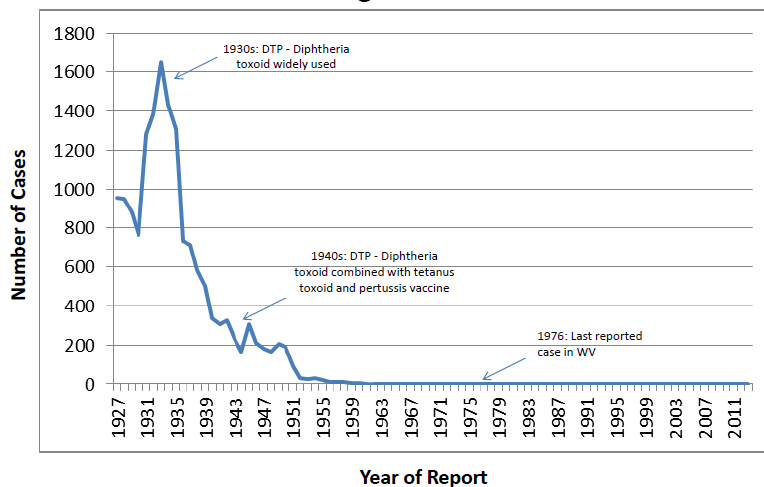
### Public Health Significance

Diphtheria was once a major cause of serious illness and death in the United States and West Virginia; after introduction of the vaccine, rates of illness declined rapidly (Figure 1). In 2003, diphtheria was declared to be eliminated from the United States, ahead of the 2010 Healthy People goal.

Figure 1 (Source:

[http://www.dhhr.wv.gov/oeps/disease/IBD\\_VPD/VPD/Documents/diphtheria-cases.pdf](http://www.dhhr.wv.gov/oeps/disease/IBD_VPD/VPD/Documents/diphtheria-cases.pdf))

Reported Cases of Diphtheria by Year of Report,  
West Virginia, 1927-2013



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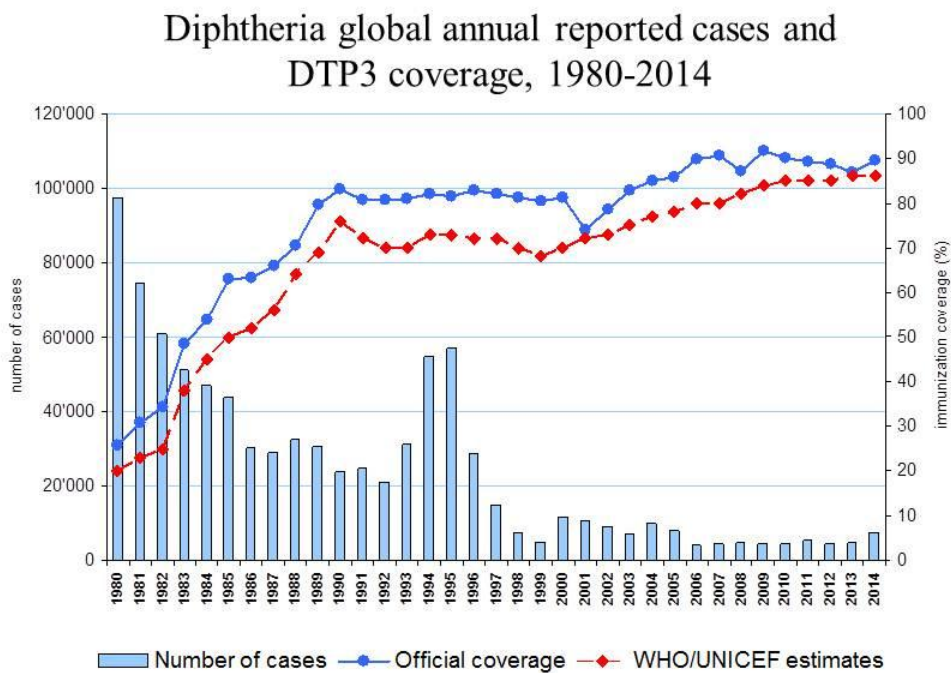
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Cases and outbreaks of diphtheria continue to occur worldwide, especially in areas with low immunization coverage (Figure 2). A total of 7,321 cases were reported to the World Health Organization in 2014.

Figure 2 (Source: [http://www.who.int/immunization/monitoring\\_surveillance/burden/diphtheria/en/](http://www.who.int/immunization/monitoring_surveillance/burden/diphtheria/en/))



Source: WHO/IVB database, 2015  
194 WHO Member States.  
Data as of July 2015

Date of slide: 14 July 2015



### Clinical Description

Diphtheria can take many forms from asymptomatic colonization lasting weeks or months; to a lethal infection resulting in death. Clinical presentations that may come to the attention of public health authorities include:

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**Tonsillar diphtheria:** this classic presentation begins abruptly with low-grade fever (~100.4 °F), sore throat and malaise. The tonsils are red with a thick grey-white exudate or 'membrane,' and there is a strong foul odor. The tonsillar and cervical lymph nodes are enlarged. The exudate slowly extends as the illness progresses, resulting in nasopharyngeal diphtheria with massive lymphadenopathy, the 'bull neck.' Most common symptoms are sore throat, painful swallowing, nausea and vomiting and headache.

**Pharyngeal diphtheria:** occurs when the membrane spreads into the pharynx

**Anterior nares diphtheria:** Usually mild and unilateral, the membrane is found in the anterior nares, associated with discharge which erodes adjacent skin, forming crusted lesions.

**Laryngeal and bronchial diphtheria:** the disease invades the larynx, resulting in hoarseness, trouble breathing, and stridor. A tracheostomy may be required to relieve obstruction of the upper airway and trachea. Involvement of bronchi is more serious and the obstruction will not be relieved by tracheostomy.

**Cutaneous diphtheria:** Diphtheria can also infect skin lesions. The classic presentation is a chronic ulcer with a grey-white membrane. However, diphtheria can superinfect wounds, impetigo, insect bites, eczema and other lesions and the presentation can be highly variable.

**Complications:** Electrocardiogram (ECG) changes are present in more than half of patients. Myocarditis occurs in 10-15%, with onset in the second week of illness. The patient develops a weak pulse, distant heart sounds; and profound weakness. Heart failure can occur. ECG changes occur and there is elevation of cardiac enzymes. The prognosis is poor, especially if heart block develops. Neuritis also occurs in 5% of diphtheria patients and 75% of patients with severe diphtheria. The most common manifestations include paralysis of the soft palate (nasal regurgitation and/or nasal speech), ciliary paralysis (eyes are dilated due to muscle paralysis) and oculomotor paralysis (eyes do not move normally due to paralysis of muscles).

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*C ulcerans* can also cause membranous tonsillitis, but toxic manifestations are less frequent.

### **Etiologic Agent**

*Corynebacterium diphtheriae* are slender, pleomorphic gram negative rod. Four biotypes: *gravis*, *intermedius*, *belfonti* and *mitis* can cause disease if they produce the diphtheria toxin. This protein toxin causes the potentially fatal cardiac and neurological complications.

*Corynebacterium ulcerans* produces a similar illness and can also produce the diphtheria toxin.

### **Reservoir**

Humans are the reservoir for *Corynebacterium diphtheriae*.

### **Mode of Transmission**

*Corynebacterium diphtheriae* is spread from one person to another through respiratory droplets or direct contact with skin lesions.

*Corynebacterium ulcerans* is spread through cow's milk.

### **Incubation Period**

2-5 days (range, 1-10 days).

### **Period of Communicability**

While carriage can persist for weeks in untreated persons, treatment with appropriate antibiotics renders a patient noninfectious within 48 hours.

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### Outbreak Recognition

Since the expected incidence of diphtheria is zero, one case is considered an outbreak.

### Laboratory Testing

CDC provides laboratory testing for diphtheria and guidance for specimen collection and specimen types is found at: <http://www.cdc.gov/diphtheria/downloads/dip-collection.pdf>  
The laboratory can perform culture, toxigenicity testing and PCR.

Specimens for culture should be taken from the nose, throat or cutaneous lesions. The membrane should be lifted so that the swab can be taken from material under the membrane.

### Case Definition

#### Probable

In the absence of a more likely diagnosis, an upper respiratory tract illness with:

- An adherent membrane of the nose, pharynx, tonsils, or larynx; AND
- Absence of laboratory confirmation; AND
- Lack of epidemiologic linkage to a laboratory-confirmed case of diphtheria.

#### Confirmed

An upper respiratory tract illness with an adherent membrane of the nose, pharynx, tonsils, or larynx; and any of the following:

- Isolation of *Corynebacterium diphtheriae* from the nose or throat; OR
- Histopathologic diagnosis of diphtheria; OR
- Epidemiologic linkage to a laboratory-confirmed case of diphtheria.

### Preventive Interventions

Age appropriate vaccination is the most important preventive measure. Adults should continue to get Td boosters every 10 years throughout their lives.

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### Treatment

Patients should be treated with antibiotics and antitoxin as soon as the diagnosis is suspected. Active vaccination should be completed during convalescence. Asymptomatic contacts should receive antibiotics and vaccine.

### Surveillance Indicators

One case of diphtheria is an outbreak. See outbreak protocol for indicators.

### References

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### **Websites**

[www.cdc.gov](http://www.cdc.gov)

<http://www.who.int/topics/diphtheria/en/>

### **Peer Review**

Maria del Rosario, December 2, 2015

Stacy Tressler, November 30, 2015

### **Author / Revisions**

Danae Bixler, December 2, 2015

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