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AUTHORITY

Diphtheria cases and carriers are reportable in British Columbia (BC) under the Reporting Information Affecting Public Health Regulation (B.C. Reg. 167/2018) under the Public Health Act. The direct link to the list of reportable diseases is here.

GOAL

The goal of the diphtheria control program in BC is to prevent primary and secondary cases of diphtheria. Control of diphtheria will be undertaken by:

- Routine immunization according to BC immunization guidelines
- Surveillance of diphtheria disease
- Prompt diagnosis
- Case and contact management

CASE DEFINITION

	DEFINITION	REPORTABLE

Confirmed case	Clinical illness [1] or systemic manifestations compatible with diphtheria in a person with an upper respiratory tract infection or infection at another site (such as a skin wound) **plus** at least one of the following:
	• Laboratory confirmation of infection:
	  ○ Isolation of *Corynebacterium diphtheriae* with confirmation of toxin from an appropriate clinical specimen including the exudative membrane; **OR**
	  ○ Isolation of other toxigenic corynebacteria species (*Corynebacterium ulcerans* or *Corynebacterium pseudotuberculosis*) from an appropriate clinical specimen, including the exudative membrane; OR
	  ○ Histopathologic diagnosis of diphtheria
	• Epidemiologic link (contact within 2 weeks prior to onset of symptoms) to a laboratory-confirmed case.
		Yes

Probable case	Clinical illness in the absence of laboratory confirmation or epidemiological link to a laboratory-confirmed case.	Yes
Carrier	A person who harbours and may disseminate toxigenic *C. diphtheriae* (or *C. ulcerans* or *C. pseudotuberculosis*) but who manifests no upper respiratory tract (pharyngitis or laryngitis) or systemic symptoms. Carriers include those with otitis media,	Yes

	nasal or cutaneous infections and asymptomatic pharyngeal infections due to toxigenic *C. diphtheriae* (or *C. ulcerans* or *C. pseudotuberculosis*).	

[1] Clinical illness is characterized as an upper respiratory tract infection (nasopharyngitis, laryngitis, or tonsillitis) with or without an adherent nasal, tonsillar, pharyngeal or laryngeal membrane, **plus** at least one of the following:

- Gradually increasing stridor (harsh, vibrating breath sound)
- Cardiac (myocarditis) or neurologic involvement (motor or sensory palsies) 1 to 6 weeks after onset
- Death, with no known cause

Note: A person with respiratory or cutaneous diphtheria caused by infections with **non-toxigenic** strains of *C. diphtheriae* is not reportable and does not require routine investigation or prophylaxis of contacts.(1)

EPIDEMIOLOGY

Etiology

Diphtheria is caused by toxigenic strains of *Corynebacterium diphtheriae. C. diphtheriae* is a non-sporulating, gram positive, irregularly staining, non-motile, pleomorphic bacillus with four biotypes (*gravis, mitis, intermedius,* and *belfanti*). All four biotypes may be toxigenic or non-toxigenic. On rare occasions, other Corynebacterium species such as *C. ulcerans* or *C. pseudotuberculosis* may produce the diphtheria toxin.(1) Non-toxin-producing strains of *C. diphtheriae* can also cause disease*,* however it is generally less severe. Cases of cutaneous or respiratory diphtheria caused by infections with nontoxigenic strains of *C. diphtheriae* are not notifiable and do not require routine investigation or prophylaxis of contacts.

Clinical Presentation

Diphtheria has several manifestations depending on the site of disease, which most commonly includes respiratory diphtheria and cutaneous diphtheria. Respiratory diphtheria affects the mucous membrane of the upper respiratory tract. Symptoms include a mild fever, sore throat, difficulty swallowing, malaise and loss of appetite. It can progress to acute respiratory distress, upper airway obstruction and asphyxia in young children. An adherent, asymmetrical, greyish-white membrane, visible on the tonsils and oropharynx, typically appears within 2 to 3 days of illness. Dissemination of diphtheria toxin can result in systemic complications such as myocarditis and central nervous system effects, beginning about 1-2 weeks after onset. The case-fatality rate is about 5% to 10%; the highest rates occur among the unimmunized who are very young, and unimmunized elderly, and in non-endemic countries, because diagnosis and specific management is often late. (1, 2) Localized infection of the skin (cutaneous diphtheria) may occur, but is rarely associated with systemic complications. Refer to Table 1 and 2 below for more information.

Table 1: Respiratory Diphtheria

Types	Disease Description
Nasal (1, 3)	• Infection of the anterior nares that presents like the common cold. • Characterized by a mucopurulent nasal discharge that may be blood-tinged. • A white membrane usually forms on the nasal septum. • The disease is typically mild because of poor systemic absorption of toxin from this location. • Infection resolves quickly with diphtheria antitoxin and antibiotic therapy.
Pharyngeal/Tonsillar (1, 3)	• Most common sites of diphtheria infection are the pharynx and the tonsils, and associated with substantial systemic absorption of toxin. • Onset is gradual and early symptoms include: malaise, sore throat, anorexia, and low-grade fever. • Within two to three days, a bluish-white membrane appears and extends from a small patch on the tonsils to covering most of the soft palate. The membrane progresses to a greyish-green colour or, if bleeding has occurred, black; firmly adherent to the tissue, and if forcible attempts are made to remove the membrane, bleeding will occur. There is minimal amount of mucosal erythema surrounding the membrane. • While recovery without treatment can occur, patients may develop severe disease. • Symptoms of severe disease include: marked edema of the submandibular areas and the anterior neck along with lymphadenopathy, giving a characteristic “bull neck” appearance. Severe prostration, pallor, rapid pulse, stupor, and coma can develop if enough toxin is absorbed, and death can occur within 6-10 days.
Laryngeal (1, 3)	• Can either be an extension of the pharyngeal/tonsillar form, or can be a primary infection site. • Symptoms include: fever, hoarseness, and a barking cough. • The membrane can lead to airway obstruction, coma, and death.

Table 2: Cutaneous (and mucus membranes) Diphtheria

Disease Description (1, 3-7)
• Skin infections may be manifested by a scaling rash or by ulcers, often painful, with clearly demarcated edges and an overlying greyish membrane. • Other rare sites of involvement include the mucous membranes of the conjunctiva and vulvovaginal area, and the external auditory canal. • Mainly manifest as chronic non-healing wounds along with isolation of other pathogens. • Common in tropical areas and among urban homeless. • Rarely associated with systemic complications.

Transmission

Humans are the sole reservoir of *C. diphtheriae.* Infection is spread by respiratory tract droplets and by contact with discharges from skin lesions, including, rarely, articles soiled with excretions of infected people.(1, 4) Transmission results from close contact with patients or carriers.

Incubation Period

The incubation period is usually 2 to 5 days (range, 1-10 days).(1)

Period of Communicability

Variable, and assessed by post-treatment culture to verify disappearance of toxin-producing strain from discharges or skin lesions. The infectious period in untreated persons is usually 2 weeks or less and, rarely, more than 4 weeks for respiratory diphtheria. Patients treated with an appropriate antimicrobial agent are usually not infectious 48 hours after treatment is initiated.(1) Chronic carriers asymptomatically colonized with *C. diphtheriae* on the skin or in the nasopharynx and may shed organisms for 6 months or more.(2, 4)

Host susceptibility

Unimmunized or underimmunized people traveling to areas with endemic diphtheria, or people who come into contact with infected travelers from such areas, are at increased risk of infection; rarely, fomites or milk products can serve as vehicles of transmission.(1, 4) Following completion of a primary immunization series, more than 97% of vaccinees develop antibody concentrations that are protective against diphtheria.(4) Severe disease occurs more often in people who are unimmunized or inadequately immunized. Fully immunized people may be asymptomatic carriers or have mild sore throat.

Incidence/Prevalence

Global

Diphtheria occurs worldwide and is endemic in many developing countries as well as in Albania, Russia and other countries of the former Soviet Union.(4) A list of countries where diphtheria is endemic is available from the United States Centers for Disease Control and Prevention (CDC). In other countries, occasional cases of imported diphtheria are identified. Resurgence of diphtheria has been reported in countries with low vaccine coverage including due to recent infrastructure degradation such as Venezuela.

National

Routine infant and childhood diphtheria immunization has resulted in achievement in BC of the national target of zero cases of respiratory diphtheria from acquisition in Canada.(8) A small

number of toxigenic strains of diphtheria bacilli are detected each year (0 to 5 isolates) and classic diphtheria is rare.(4)

CASE MANAGEMENT

Consult with the Medical Health Officer and initiate control measures immediately upon the identification of a case, including a clinical or suspect case, if the risk assessment is suggestive of diphtheria. Initiation of control measures need not await laboratory confirmation including confirmation of toxin production.

Diagnosis

Early recognition is essential to the successful diagnosis and timely institutions of control measures. Diagnosis is usually based on history, clinical presentation and laboratory testing. A clinical suspicion of diphtheria should be raised by a presentation of an upper respiratory tract illness (laryngitis, nasopharyngitis, or tonsillitis) with fever, enlarged anterior cervical lymph nodes, and a thick, greyish adherent membrane covering the throat and tonsils, especially in conjunction with incomplete immunization and travel history or compatible exposure. Although a membrane is considered typical of diphtheria, it is not always present.(1)

The BCCDC Public Health Laboratory should be notified as soon as the diagnosis of respiratory diphtheria is suspected as the successful isolation of *C. diphtheriae* depends on the rapid inoculation of specimen of special culture media. Refer to the eLab Handbook for more information on specimen collection recommendations.

Specimens taken for culture should be obtained BEFORE starting antibiotic treatment. Isolation of toxin-producing *C. diphtheriae* by culture from throat specimens (including swab of membrane if present) for respiratory diphtheria and skin lesion swabs for cutaneous diphtheria, confirms diagnosis. While all respiratory site isolates will be routinely sent to the National Microbiology Laboratory in Winnipeg for toxin testing, cutaneous site isolates will only be sent for toxin testing if requested by the clinician who collected the sample based on the clinical context (e.g., travel to an endemic area and/or wound presentation [see Table 2]), as the vast majority of cutaneous site isolates with *C. diphtheriae* identified in BC are non-toxigenic strains.

Do not wait for results before initiating treatment; confirmatory diagnosis requires culture and isolation of the organism, biochemical typing, and toxigenicity testing, which may take several days. Culturing of samples from both the nasal and pharyngeal sites may improve the rate of isolation of *C. diphtheriae* although nasal diphtheria in the absence of pharyngeal involvement is uncommon. If a membrane is present, samples should be taken from the membrane or beneath its edge.

Treatment

Table 3: Treatment

Type	Description of Treatment
Respiratory (1, 2, 9)	**Diphtheria Antitoxin (DAT)** • DAT is considered the mainstay of treatment as it neutralizes circulating toxin and prevents progression of disease. • Prompt administration of DAT is essential and should begin as soon as possible based on clinical symptoms without awaiting laboratory confirmation. • A patient's eligibility for DAT will be determined through consultation with the treating physician and the Medical Health Officer (MHO). ○ If, after consultation, it is the decision of the treating physician to give DAT, it will be released by MHO request to BCCDC Pharmacy. • Before administration of DAT, tests for sensitivity to horse serum should be performed; refer to Appendix 1 for more information. Severe hypersensitivity to DAT ranges from 0.01 to 3% in the available literature. • The DAT dosage depends on the site and size of the membrane, duration of illness, and degree of toxic effects. Refer to Appendix 1 for the recommended DAT doses and modes of administration.
	Antibiotics • Antibiotic treatment with penicillin, erythromycin or another macrolide such as azithromycin or clarithromycin is needed to eliminate the organism and prevent spread. Refer to Appendix 2 for antibiotic treatment recommendations. Antimicrobial susceptibility testing may be required. • Antibiotic treatment is not a substitute for antitoxin, but will eliminate *C. diphtheriae* and halt toxin production, and reduce communicability. • Cases should be treated for 14 days and have two negative cultures of throat and nasopharyngeal swabs taken at least 24 hours apart and a minimum of 24 hours after antibiotic treatment has completed. • Persistent carriage of the organism should be treated with an additional 10-day oral course of antibiotics, and repeat cultures as above. • If cultures remain positive after the additional 10-day course of antibiotics, consult with an infectious disease specialist on further antibiotic treatment recommendations.
Cutaneous (1, 2, 9, 10)	**Antibiotics** • DAT is not recommended for cutaneous diphtheria, except in rare cases with signs of systemic toxicity (fever, tachycardia [myocarditis], and weakness [neuropathy]). • Thorough cleansing of the lesion with soap and water. • Antibiotic treatment with penicillin, erythromycin or another macrolide such as azithromycin or clarithromycin for 14 days is recommended. Refer to Appendix 2 for antibiotics treatment recommendations. Antimicrobial susceptibility testing may be required. • Cases should be treated for 14 days and have two negative cultures swabs from skin lesion taken at least 24 hours apart and a minimum of 24 hours after

	antibiotic treatment has completed. If skin lesion/wound has healed, swab skin where lesion/wound located. • Persistent carriage of the organism should be treated with an additional 10-day oral course of antibiotics, and repeat cultures as above. • If cultures remain positive after the additional 10-day course of antibiotics, consult with an infectious disease specialist on further antibiotic treatment recommendations.

Infection Prevention and Control Strategies

Case *	Precautions
Respiratory Cases and Respiratory Carriers (1, 2, 9, 11)	**Hospitalized:** • Isolation, contact and droplet precautions apply until two cultures from both nose and throat taken at least 24 hours apart, and at least 24 hours after cessation of antimicrobial therapy, are negative.
	Non-hospitalized: • Contact and droplet precautions apply until two cultures from both nose and throat, taken at least 24 hours apart and at least 24 hours after cessation of antimicrobial therapy, are negative. • Individuals with non-severe disease can be treated and followed by a community physician with support from public health professionals. Consultation with an infectious disease specialist may be required to determine appropriate course of treatment and follow-up.
Cutaneous (1, 2, 11)	**Hospitalized:** • Routine and contact precautions apply until two cultures of skin lesions, taken at least 24 hours apart and at least 24 hours after cessation of antimicrobial therapy, are negative.
	Non-hospitalized: • Individuals are most commonly treated and followed by a community physician with support from public health professionals. Consultation with an infectious disease specialist may be required to determine appropriate course of treatment and follow-up. • Recommend minimal contact with others until two cultures from skin lesions, taken at least 24 hours apart and at least 24 hours after cessation of antimicrobial therapy, are negative. • Articles in contact with infected individual and articles soiled by discharges of the case should be washed as per normal practices.

***** With confirmation of toxigenic strain or high index of suspicion for toxicity with toxin testing pending.

General guidance to cases should include:

- Information about the disease transmission and measures to minimize transmission
- Strict attention to personal hygiene by:
    - Covering mouth and nose with a tissue when coughing,
    - Placing all contaminated tissues directly into garbage,

- Washing hands with soap and water every time there is contact with respiratory secretions or infected wounds, and
- Keep all infected wounds covered.

Since infection with diphtheria does not always confer immunity, assess immunization status of persons recovering from diphtheria disease and offer immunization as necessary to complete a primary series of diphtheria-containing vaccine or administer a booster dose as per the BC Immunization Manual, Part 1 – Immunization Schedules (as indicated by age and immunization history).

Exclusion from workplace, school, or child care setting

The Medical Health Officer shall exclude cases from workplaces, schools or child care settings until 14 days of antibiotic therapy is completed and two cultures from the nose, throat and/or skin lesions collected at least 24 hours after cessation of antimicrobial therapy are negative.

CONTACT AND CARRIER MANAGEMENT

Follow-up of contacts is only recommended for cases or carriers with confirmation of a toxigenic strain of *Corynebacterium* species or those with a high index of suspicion for toxicity with toxin testing pending*****. Risk of infection is directly related to the duration of contact, the type of contact and the intensity of exposure.

Close Contact Definition

Individuals who were in contact with the case (i.e., case or carrier with confirmation of a **toxigenic** *Corynebacterium* species or high index of suspicion for toxicity with toxin testing pending*****) in the previous 10 days AND are:

- Living in the same household or share sleeping arrangements,
- Kissing and/or sexual contacts,
- Children and staff in child care and preschool facilities,
- Persons who had direct contamination of the nose or mouth with oral and/or nasal secretions of the case (e.g., kissing, shared cigarettes, shared drinking bottles or utensils),
- Healthcare staff exposed to oropharyngeal secretions of the case without appropriate infection prevention and control precautions, and/or
- Regular visitors in the home (e.g., grandparents, housekeeper, tutor).
- For cutaneous carriers: Individuals who have been in direct contact with the wound(s) or provided wound care in the absence of appropriate personal protective equipment.

*** NOTE**: If the strain is shown to be non-toxigenic, the investigation of contacts can be discontinued.(5)

Management of Contacts

- Provide information about diphtheria disease including signs and symptoms.
- Determine the type of exposure, the setting, and the time since last exposure from the case.
- All close contacts should have a single swab for culture taken from each of the nose, the throat and skin lesions (where present).
- Collect swabs PRIOR to initiating antibiotic prophylaxis. See post-exposure prophylaxis section for more details.
- Refer symptomatic contacts for assessment as appropriate.
- Any asymptomatic contact identified as having a positive swab for *C. diphtheriae* (or *C. ulcerans* or *C. pseudotuberculosis*) should be treated as a carrier (see Management of Carriers section below). Samples should be sent for toxigencity testing; however given the high index of suspicion for toxicity due to close contact with a case of toxigenic *C. diphtheriae*, manage the client as a 'Carrier'.
- Advise asymptomatic contacts to monitor closely for symptoms for at least 10 days after their last exposure with the infected person and to notify public health if they develop symptoms.
- Determine diphtheria-specific immunization history (i.e., type of vaccine, number of doses and date of administration).
- Contacts not up-to-date for diphtheria immunization should be offered age-appropriate diphtheria-containing vaccine according to the BC Immunization Manual, Part 1 – Immunization Schedules.

Post-Exposure Prophylaxis (PEP) of Contacts

- PEP should be offered to close contacts regardless of their immunization status and AFTER swabs from the nose, throat and skin lesions (where present) have been taken.
- Contacts are given PEP to treat incubating disease and eliminate carriage and thereby reduce risk of transmission to other susceptible contacts.
- Recommended antibiotics for PEP are penicillin, erythromycin or another macrolide such as azithromycin or clarithromycin. For more information, refer to Appendix 2: Recommended Antibiotics for Treatment and Prophylaxis.
- There is no role for prophylactic use of DAT for contacts.
- Eligible contacts should receive diphtheria-containing vaccine as per the BC Immunization Manual, Part 1 – Immunization Schedules to ensure they are up-to-date for diphtheria immunization; to those previously immunized but without a dose in the past 5 years, a booster dose of the age-appropriate product containing diphtheria toxoid should be administered. NOTE: While diphtheria immunization is highly protective against disease caused by toxin-producing strains, it does not prevent or eliminate carriage of *C. diphtheriae*.(5)
- Contacts who do not receive PEP should be monitored for 10 days and treated as a case of diphtheria if symptoms develop.

Management of Carriers

Carrier Definition

A carrier is defined as a person who harbors and may transmit **toxigenic** *C. diphtheriae* (or *C. ulcerans* or *C. pseudotuberculosis*) but who manifests no upper respiratory tract (pharyngitis or laryngitis) or systemic symptoms. In BC, most carriers have isolates from cutaneous sites (wounds).

Treatment includes:

- DAT is not recommended for asymptomatic carriers.
- Carriers should be given antibiotic treatment regardless of immunization status.
- Antibiotic treatment with penicillin, erythromycin or another macrolide such as azithromycin or clarithromycin for 10 days is recommended. Refer to Appendix 2 for antibiotics treatment recommendations. Antimicrobial susceptibility testing may be required.
- Carriers should be treated for 10 days and have two negative cultures from swabs from both the nose and throat and/or skin lesion taken at least 24 hours apart and a minimum of 24 hours after antibiotic treatment has completed. If skin lesion/wound has healed, swab skin where lesion/wound had been located.
- Persistent carriage of the organism should be treated with an additional 10-day oral course of antibiotics, and repeat cultures as above.
- If cultures remain positive after the additional 10-day course of antibiotics, consult with an infectious disease specialist on further antibiotic treatment recommendations.

Contact management of asymptomatic carriers of **toxigenic** *C. diphtheriae* is advised. Current close contacts should be identified, unless there is a suspected time of acquisition, in which case all close contacts since that time should be identified.(9)

Exclusion of Contacts and Carriers

The Medical Health Officer (MHO) shall exclude carriers of toxigenic *C. diphtheriae* until antibiotic treatment is complete and they have had two negative cultures from nose, throat, and lesions (if present) at least 24hrs apart and at least 24hrs after cessation of antimicrobial therapy.

The MHO may consider excluding contacts, until the first set of negative specimen results, pending a risk assessment of the degree of exposure to the contact and whether they have contact with un/under-immunized children or medically frail or immunocompromised individuals.

For more information, refer to Appendix 3: Management of Contacts Algorithm.

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APPENDICES

Appendix 1: Diphtheria Antitoxin Dosages

Antitoxin dosage depends on the site and extent of the diphtheritic membrane, the degree of toxicity, and the duration of illness. Although the intravenous route is preferred for administration of diphtheria antitoxin (DAT), intramuscular injection may be considered for less severe cases.(6) Consult the product monograph for additional specifications.

Table 4: Equine diphtheria antitoxin dosages recommended for various types of diphtheria (Pediatric and Adult) (10, 12)

Type of Diphtheria	Dose (units)	Route
MILD FORM (nose, tonsils, skin [rare case where treatment is indicated])	20,000 – 40,000	IV or IM
MODERATE FORM (larynx, pharynx, or combined types [e.g., nasopharyngeal disease])	40,000 – 80,000	IV or IM
SEVERE FORM (extensive disease of 3 or more days duration, and/or severe swelling of neck [bull-neck])	80,000 – 100,000	IV or IM

IM = Intramuscular
IV = Intravenous

Precautionary measures

DAT is an equine serum product and precautionary measures are recommended for all patients due to the risk of serious anaphylactic reactions. Severe hypersensitivity reactions occur at a rate of about 0.01-3% of DAT recipients.(12, 13) The administration of DAT should occur in a setting equipped with the necessary medications, equipment and staff competent to manage and treat anaphylactic reactions. Prior to DAT administration, all patients should be assessed for factors suggesting increased risk of developing serious anaphylactic reactions, including(10):

- Asthma, allergic rhinitis, or urticaria or other allergic symptoms with or without proximity to horses
- Previous injection of serum of equine origin

The absence of previous allergic reactions or receipt of animal-derived immunoglobulin does not rule out the possibility of adverse reactions, and as such, **ALL** patients should be closely monitored for adverse reactions, particularly hypotension and bronchoconstriction, during DAT administration.

A test for sensitivity to DAT should be carried out prior to each time DAT is administered. Some DAT product monographs do not recommend sensitivity testing prior to the administration of

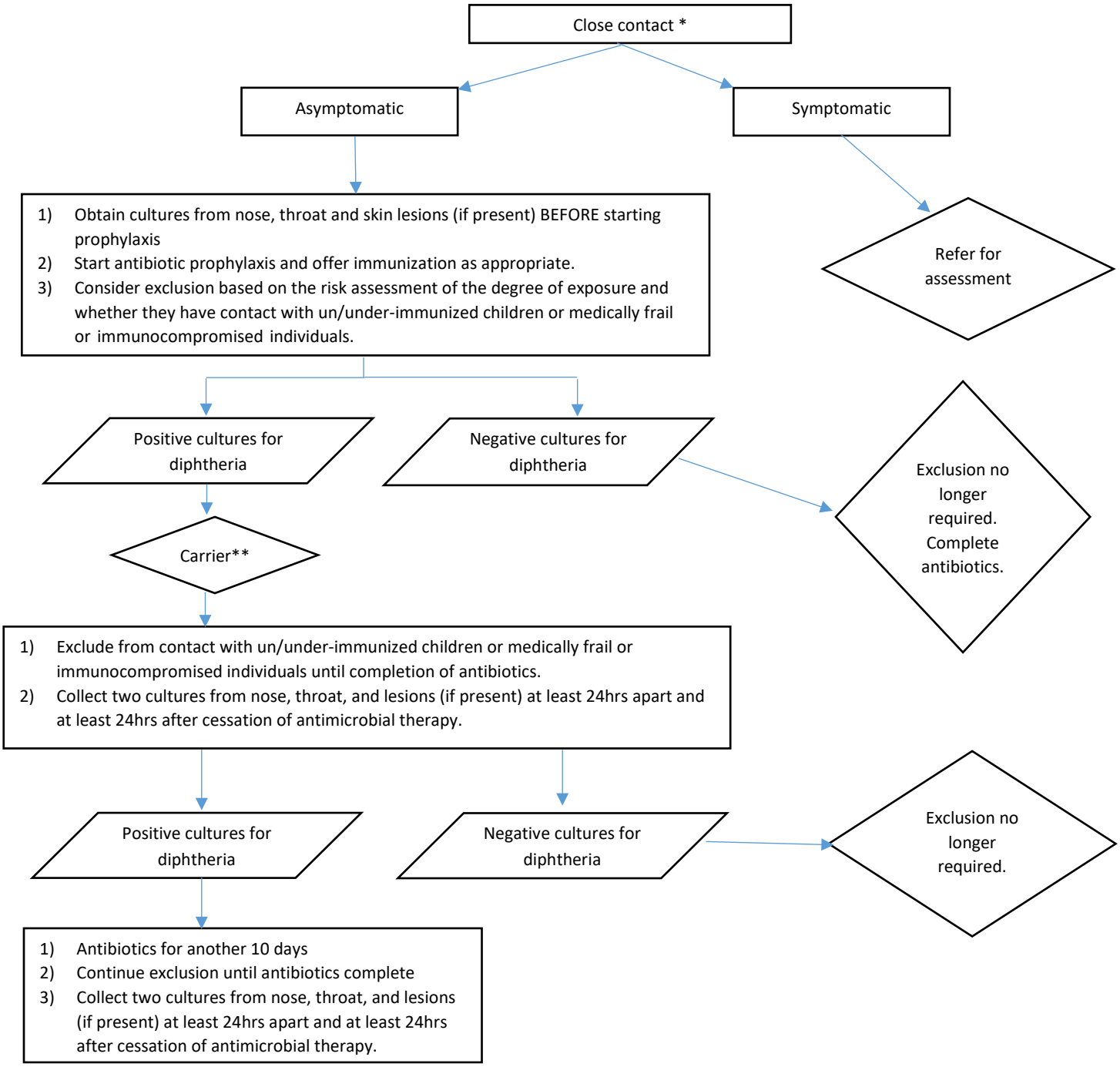
DAT(12), however, sensitivity testing is still the standard and recommended practice in all references reviewed, and continues to be recommended in BC for all patients prior to the administration of DAT. Refer to the Centers for Disease Control and Prevention. Expanded Access Investigational New Drug (IND) Application Protocol: Use of Diphtheria Antitoxin (DAT) for Possible Diphtheria Cases for a guide on sensitivity testing, and desensitization protocols, if necessary.

Appendix 2: Recommended Antibiotics for Treatment and Prophylaxis

Antibiotic therapy prevents the propagation of organisms and further elaboration of toxin while decreasing transmission.(6) *C. diphtheriae* is susceptible to a wide range of antimicrobials; penicillin and erythromycin have traditionally been used for treatment.

	Antibiotic
Case (1-3, 6, 9, 10, 14)	**Procaine Penicillin G** 300,000 units IM every 12 hours for patients ≤10 kg 600,000 units IM every 12 hours for patients >10 kg *until the patient can take oral medicine, followed by*: **Penicillin V** 125mg-250 mg orally four times daily for a total treatment course of 14 days. ***OR*** **Erythromycin** 40-50mg/kg parenterally or orally (max 2g/day), in four divided doses, for a total treatment course of 14 days **Other Macrolide** *If the first two options are not available or cannot be tolerated, another macrolide such as **azithromycin** or **clarithromycin** should be used, however, antimicrobial susceptibility testing may be required. (2, 9)*
Contact / Carrier (1, 2, 6, 9, 10, 14)	**Penicillin G benzathine** <30kg: 600,000 units IM one time ≥30kg: 1.2 million units IM one time ***OR*** **Erythromycin** 40-50mg/kg orally (max 1g/day) per day, in four divided doses, for 7-10 days **Other Macrolide** *If the first two options are not available or cannot be tolerated, another macrolide such as **azithromycin** or **clarithromycin** should be used, however, antimicrobial susceptibility testing may be required.(2, 9)*

Appendix 3: Management of Contacts Algorithm



* For close contacts of asymptomatic carriers, contact management should not proceed until there is confirmation of **toxigenic** *C. diphtheriae* (or C. *ulcerans* or C. *pseudotuberculosis*) – see 'Carrier' in Case Definition.

** Samples should be sent for toxigencity testing; however given the high index of suspicion for toxicity due to close contact with a case of toxigenic C. *diphtheriae,* manage the client as a 'Carrier'.