Appendix A: Disease-Specific Chapters

Chapter: Diphtheria

Ontario

Diphtheria

☒ Communicable
☒ Virulent

Health Protection and Promotion Act, Section 1 (1)

Health Protection and Promotion Act:
Ontario Regulation 558/91 – Specification of Communicable Diseases

Health Protection and Promotion Act:
Ontario Regulation 559/91 – Specification of Reportable Diseases

1) Aetiologic Agent:	Diphtheria is caused by *Corynebacterium diphtheriae (C. diphtheriae)*, a gram-positive bacillus with four biotypes of *C. diphtheriae (gravis, mitis, belfanti and intermedius)* (1). Strains may be toxigenic or nontoxigenic. Only the toxigenic strain produces exotoxin and can cause serious diseases. The nontoxigenic strain may produce a milder symptomatic clinical illness and has been increasingly associated with infective endocarditis (2).

2) Case Definition:

Surveillance Case Definition	See Appendix B
Outbreak Case Definition	The outbreak case definition varies with the outbreak under investigation. Consideration should be given to the following in establishing an outbreak case definition: 1. Clinical, laboratory and/or epidemiological criteria; 2. A time frame for occurrence; 3. A geographic location(s) or place(s) where cases live or became ill/exposed, and 4. Special attributes of cases (e.g. age, underlying conditions). Cases should also be classified by levels of probability (i.e. confirmed, probable or suspect).

3) Identification:

Clinical Presentation	An acute bacterial disease primarily involving the pharynx, tonsils, larynx, nose, occasionally other mucous, membranes or skin and sometimes conjunctivae or vagina. The characteristic lesion, caused by liberation of a specific cytotoxin, is an asymmetrical adherent greyish white membrane with surrounding inflammation (2). The disease has a number of manifestations depending on the site of

	infection. For nasal site symptoms include a mucopurulent nasal discharge, which may become blood tinged and a membrane may form on the nasal septum. The most common site of infection is the pharyngeal/tonsillar area. Cases present with malaise, sore throat, anorexia and low-grade fever. Two to three days later the membrane appears in the area, which may obstruct breathing in severe cases, or the individual may recover depending on the amount of toxin absorbed. In laryngeal infection, symptoms include fever, hoarseness, and a barking cough. Development of the membrane may lead to airway obstruction, coma and death (3). Late effects of absorption of the toxin include cranial and peripheral motor and sensory nerve palsies, myocarditis and neuritis (3, 4). Cutaneous infection is often associated with overcrowding and homelessness and is manifested by a rash or by ulcers with demarcated edges and membrane. Generally the organisms isolated from these lesions are nontoxigenic.
Diagnosis	See Appendix B Note: Notify your local public health laboratory prior to submitting a specimen for testing. Specify, “diphtheria culture on the requisition” (5).

4) Epidemiology:

Occurrence	Diphtheria occurs worldwide but is a rare disease in countries where children and adults are immunized. It is typically a disease of colder months in temperate climates involving children less than 15 years of age and in persons who have not been immunized (2,3). There have been no confirmed cases of diphtheria reported in Ontario from 1998-2007. Given its rarity in Ontario, a single confirmed case constitutes an outbreak.
Reservoir	Humans (2)
Modes of Transmission	Transmission is most common from close intimate contact with a case or carrier by respiratory droplet and direct spread from nose/throat secretions, and from eye and skin lesions (2, 6). Transmission via fomites, raw milk and milk products is rare.
Incubation Period	Usually 2-5 days, occasionally longer (2) a range from 1-10 days (3).
Period of Communicability	Variable; until virulent bacilli have disappeared from discharges and lesions, usually 2 weeks or less, seldom more than 4 weeks (2). Effective antibiotic therapy promptly terminates shedding. The rare chronic carrier may shed organisms for 6 months or more (2, 3).
Susceptibility and Resistance	Routine vaccination is recommended as per the Publicly Funded Immunization Schedules for Ontario. Immunization with diphtheria toxoid produces prolonged but not lifelong immunity. Lifelong

	immunity is generally, but not always, acquired following disease or inapparent infection (2).

5) Reporting Requirements:

To local Board of Health	Confirmed and suspected cases shall be reported **immediately** to the medical officer of health by persons required to do so under the *Health Protection and Promotion Act*, R.S.O. 1990.
To Public Health Division (PHD)	Report only case classifications specified in the case definition immediately to the Public Health Division or if after hours to the on-call manager in order to obtain diphtheria antitoxin. Cases shall be reported using the integrated Public Health Information System (iPHIS), or any other method specified by the Ministry **within one (1) business days of receipt of initial notification** as per *iPHIS Bulletin* Number 17: Timely Entry of Cases (7). The minimum data elements to be reported for each case is specified in the following: • *Ontario Regulation 569* (Reports) under the HPPA; • The disease-specific User Guides published by the Ministry, and • Bulletins and directives issued by the Ministry.

6) Prevention and Control Measures:

Personal Prevention Measures	Most effective measure for prevention is immunization. Use educational strategies to inform the public about: (1) • Primary immunization with diphtheria toxoid given in combination with tetanus toxoid, acellular pertussis and polio vaccine as per the Publicly Funded Immunization Schedules for Ontario • Adolescents should receive a booster dose of diphtheria containing vaccine at 14 to 16 years of age and given as the combined tetanus toxoid, diphtheria toxoid and acellular pertussis (Tdap) vaccine • Adults should receive a booster of diphtheria containing vaccine every 10 years given in combination with tetanus toxoid as Td
Infection Prevention and Control Strategies	Strategies (5) : • For hospitalized cases, in addition to routine practices, droplet precautions are recommended for cases and carriers with pharyngeal diphtheria until two cultures from both the nose and throat collected 24 hours after completing antimicrobial treatment are negative for *C. diphtheriae* • Contact precautions are recommended for cases with cutaneous diphtheria until two cultures of skin lesions taken at

	least 24 hours apart and 24 hours after cessation of antimicrobial therapy are negative
Management of Cases	Refer to Regulation 569 under the HPPA regarding factors to investigate. Investigate to determine immunization status of case and contacts; confirm diagnosis and determine any travel history within the last two weeks to find possible source of infection (2). Treatment of clinical cases should not be delayed until laboratory confirmation. Treatment is under the direction of the attending health care provider in consultation with an infectious diseases specialist. Diphtheria antitoxin should be administered as soon as possible. It is **only available through the Public Health Division.** Ontario has obtained a small supply of antitoxin through the federal Special Access Program. Antibiotic therapy is needed to eliminate the organism and prevent spread and is not a substitute for antitoxin. Throat and nasopharyngeal swabs should be taken prior to starting antibiotic therapy. Erythromycin and penicillin are effective against the organism and either can be administered after cultures have been obtained for a total of 14 days of treatment (4). The management of cases involves respiratory isolation until: • 2 cultures from throat, nose or lesions have been taken 24 hours apart and are negative for *C. diphtheriae* (1). • Cultures are taken 25 hours after completion of treatment The elimination of *C. diphtheriae* should be confirmed following treatment (refer to the CCDR guideline listed below). Once recovered, the case should receive a primary series of diphtheria –containing vaccine according to the publicly funded immunization schedule for Ontario and the age of the case. More details on case management are available in Health Canada's "Guidelines for the Control of Diphtheria in Canada" (4).
Management of Contacts	Contacts are defined as household members, persons who have had close face-to-face contact to a case such as intimate contact, sharing same room at school or work and health care workers exposed to oropharyngeal secretions from the case (4). All identified contacts should have swabs taken from nose and throat and sent for culture regardless of immunization status. They should also be started on a prophylactic course of seven days with oral erythromycin or given a single dose of procaine penicillin IM as prophylaxis. They should also be kept under surveillance for seven days for signs and symptoms of disease. Inadequately immunized contacts should receive appropriate immunization (4). Contacts must be excluded from occupations involving food handling,

	close contact with children under 7 years of age or known unimmunized persons, care of the sick and from school until treatment is complete and cultures from the nose and throat or lesions are negative (4). Refer to the PHAC guideline listed below for more information.
Management of Outbreaks	A single confirmed case of diphtheria is suggestive of an outbreak. Provide pubic health management of outbreaks or clusters in order to identify the source of illness, stop the outbreak and limit secondary spread. Outbreaks of diphtheria require immunizing the largest possible proportion of the population involved, emphasizing the need for protection of infants and preschool children. Repeat immunization may be recommended after one month (1). This will be under the direction of the Public Health Division. For outbreak in a school, susceptible students can be excluded under Section 12 of the Immunization of School Pupils Act**.** As per this Protocol, outbreak management shall comprise of but not be limited to the following general steps: • Confirm diagnosis and verify the outbreak; • Establish an outbreak team; • Develop an outbreak case definition; • Implement prevention and control measures; • Implement and tailor communication and notification plans depending on the scope of the outbreak; • Conduct epidemiological analysis on data collected; • Conduct environmental inspections of implicated premise where applicable; • Coordinate and collect appropriate clinical specimens where applicable; • Prepare a written report, and • Declare the outbreak over in collaboration with the outbreak team.
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8) Additional Resources	Public Health Agency of Canada. Vaccine-Preventable Diseases [Internet]. Ottawa: Public Health Agency of Canada; 2008. Diphtheria; 2002 Oct 31 [cited 2009 Feb 11]. Available from http://www.phac-aspc.gc.ca/im/vpd-mev/diphtheria-eng.php. Health Canada, Laboratory Centre for Disease Control, Division of Nosocomial and Occupational Infections. Routine practices and additional precautions for preventing the transmission of infection in health care.Can Commun Dis Rep. 1999 Jul;25 Suppl 4:1-142. Available from http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/99pdf/cdr25s4e.pdf. *Immunization of School Pupils Act*, R.S.O. 1990, c. I.1. Available from http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90i01_e.htm. *Health Protection and Promotion Act*, R.S.O. 1990, c. H.7. Available from http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90h07_e.htm. Ministry of Health and Long-Term Care. Infectious diseases protocol. Toronto: Queen's Printer for Ontario; 2009. Available from http://www.health.gov.on.ca/english/providers/program/pubhealth/oph_standards/ophs/infdispro.html (or as current) Plotkin SA, Orenstein WA, Offit PA, editors. Vaccines. 5th ed. Philadelphia: Saunders; 2008. Funke G, Bernard K. Coryneform gram-postive rods. In: Murray PR, Baron JH, Jorgenson M, Pfaller A, Yolken RH, editors. Manual of clinical microbiology. 8th ed. Washington: ASM Press; 2003. p. 319-45. National Advisory Committee on Immunization. Canadian immunization guide. 7th ed. Ottawa: Public Health Agency of Canada;

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