

Ministry of Health
Infectious Diseases Protocol

Appendix A: Disease-Specific Chapters

Chapter: Typhoid Fever
Effective: February 2019

Typhoid Fever

Communicable

Virulent

**Health Protection and Promotion Act:
O. Reg. 135/18 (Designation of Diseases)**

1.0 Aetiologic Agent

Typhoid fever is caused by the gram-negative bacillus known as *Salmonella enterica* serovar Typhi (commonly S. Typhi).¹

2.0 Case Definition

2.1 Surveillance Case Definition

Refer to [Appendix B](#) for Case Definitions.

2.2 Outbreak Case Definition

The outbreak case definition varies with the outbreak under investigation. Please refer to the *Infectious Diseases Protocol, 2018* (or as current) for guidance in developing an outbreak case definition as needed.

The outbreak case definitions are established to reflect the disease and circumstances of the outbreak under investigation. The outbreak case definitions should be developed for each individual outbreak based on its characteristics, reviewed during the course of the outbreak, and modified if necessary, to ensure that the majority of cases are captured by the definition. The case definitions should be created in consideration of the outbreak definitions.

Outbreak cases may be classified by levels of probability (*i.e.* confirmed and/or probable).

3.0 Identification

3.1 Clinical Presentation

The clinical presentation of typhoid fever is highly variable. Typically, symptoms include fever, headache, constipation or diarrhea, fatigue, abdominal pain or discomfort, and loss of appetite.¹⁻³ In more severe cases, symptoms may worsen and cause life threatening complications involving many body systems, such as enlargement of the liver and spleen or intestinal bleeding.¹⁻³ Constipation is more common than diarrhea in adults.² In up to 25% of light-skinned people small erythematous maculopapular lesions (rose spots) on the trunk are seen in the first week of fever.² Severity is influenced by

factors such as strain virulence, quantity of inoculum ingested, duration of illness before treatment, age, and previous exposure to typhoid vaccination.²

3.2 Diagnosis

See [Appendix B](#) for diagnostic criteria relevant to the Case Definitions.

For further information about human diagnostic testing, contact the Public Health Ontario Laboratories or refer to the Public Health Ontario Laboratory Services webpage: <http://www.publichealthontario.ca/en/ServicesAndTools/LaboratoryServices/Pages/default.aspx>

Note: blood may be positive as early as the first week of illness; feces and urine after the first week.²

4.0 Epidemiology

4.1 Occurrence

Worldwide.² It is common in developing countries with poor sanitation and low standards of hygiene.³ Unlike other enteric diseases, typhoid fever does not demonstrate a seasonal pattern in Ontario because it is almost always associated with travel to endemic regions of the world.

Between 2013 and 2017, an average of 73 cases of typhoid fever were reported per year in Ontario.*

Please refer to Public Health Ontario's (PHO) Reportable Disease Trends in Ontario reporting tool and other reports for the most up-to-date information on infectious disease trends in Ontario.

<http://www.publichealthontario.ca/en/DataAndAnalytics/Pages/DataReports.aspx>

For additional national and international epidemiological information, please refer to the Public Health Agency of Canada and the World Health Organization.

4.2 Reservoir

Exclusively humans; family contacts may be transient or permanent carriers. A carrier state may follow acute illness, mild illness, or even sub-clinical infections. Short-term fecal carriers are more common than urinary carriers. The chronic carrier state is most common among persons infected during middle age, especially women, and they frequently have biliary tract abnormalities including gallstones. A chronic urinary carrier state may occur with schistosome infections or kidney stones.²

4.3 Modes of Transmission

Transmitted by the fecal-oral route mainly through the ingestion of food and water contaminated by feces and urine of patients and carriers. Common vehicles include

* Data included in the epidemiological summary are from January 1, 2013 to December 31, 2017. Data were extracted from Query on February 7, 2018 and therefore are considered preliminary.

contaminated water, beverages and ice made with contaminated water, shellfish (particularly oysters), contaminated milk and milk products, raw fruit and vegetables grown in fields fertilized with sewage.^{2,3} Sexual transmission of typhoid fever from an asymptomatic carrier has been documented.² Other established risk factors include history of contact with other cases especially contact with feces and contact with urine of persons infected from schistosomiasis endemic areas. The risk of transmission increases with improper hand hygiene and poor sanitation.³ Flies may act as vectors.²

4.4 Incubation Period

From 3 days to over 60 days; usual range is 8 to 14 days depending on inoculum and on host factors.²

4.5 Period of Communicability

Typhoid fever is communicable as long as *S. Typhi* is being excreted in stools or urine, usually from one week after symptom onset, through convalescence, and for a variable period thereafter.² About 10% of untreated typhoid fever cases have detectable bacteria in their stool for three months after onset of symptoms. Both treated and untreated patients can become chronic carriers (carriage for more than one year following illness).²

4.6 Host Susceptibility and Resistance

Susceptibility is general and is increased in individuals with gastric achlorhydria and possibly in those who are HIV positive. Relative specific immunity follows recovery from clinical disease, inapparent infection and active immunization. In endemic areas, typhoid fever is most common in preschool children and children 5-19 years of age.²

5.0 Reporting Requirements

As per Requirement #3 of the “Reporting of Infectious Diseases” section of the *Infectious Diseases Protocol, 2018* (or as current), the minimum data elements to be reported for each case are specified in the following:

- *Ontario Regulation 569* (Reports) under the *Health Protection and Promotion Act* (HPPA);⁴
- The iPHIS User Guides published by PHO; and
- Bulletins and directives issued by PHO.

6.0 Prevention and Control Measures

6.1 Personal Prevention Measures

Prevention measures:

- Education on proper hygiene, especially hand washing before food preparation and eating, and after using sanitary facilities;
- Practice food and water precautions while travelling in endemic areas: avoid consumption of unpasteurized milk and raw or undercooked shellfish, particularly

shellfish harvested from water contaminated with human waste, wash fresh produce before cutting or consuming and thoroughly cook all food derived from animal sources;

- Shellfish should be boiled or steamed for at least 10 minutes before consumption;
- Vaccination should be considered for laboratory workers, household members of known carriers, and persons travelling to endemic high-risk areas; and
- Travellers should be referred to travel clinics to assess their personal risk and appropriate preventive measures.²

For more food safety prevention measures, please see the Ministry of Health's food safety frequently asked questions available from:

<http://www.health.gov.on.ca/en/public/programs/publichealth/foodsafety/faq.aspx>

6.2 Infection Prevention and Control Strategies

Contact precautions are recommended for symptomatic, hospitalized cases.^{1,2}

Properly implemented exclusion requirements can contribute to the prevention and control of secondary cases. Exclusion criteria are detailed below.

Refer to PHO's website at www.publichealthontario.ca to search for the most up-to-date Provincial Infectious Diseases Advisory Committee (PIDAC) information on Infection Prevention and Control.

6.3 Management of Cases

In addition to the requirements set out in the Requirement #2 of the "Management of Infectious Diseases – Sporadic Cases" and "Investigation and Management of Infectious Diseases Outbreaks" sections of the *Infectious Diseases Protocol, 2018* (or as current), the board of health shall investigate cases to determine the source of infection. Refer to Section 5: Reporting Requirements above for relevant data to be collected during case investigation. The following disease-specific information should also be obtained during the incubation period:

- History of out-of-province or international travel; include earliest and latest exposure dates;
- Typhoid fever immunization status (note vaccine information);
- Known exposure to a carrier or unreported case including recent (last 60 days) contact with visitors from or travelers to endemic country;
- History of occupation involving vulnerable populations, food handling, childcare and healthcare; and
- Food history, including consumption of common food vehicles as listed above during 14 days prior to symptom onset.

Identify close contacts (see definition below).

Educate the case about transmission of infection and proper hand hygiene.

Treatment with antibiotics and follow up is under the direction of the attending health care provider. Where possible, physicians should be encouraged to request antibiotic

sensitivity testing due to resistant strains. Note any treatment prescribed including name of medication, dose, and duration of treatment, start and finish dates.

The following exclusion criteria were adopted from the British Columbia Centre for Disease Control (BC CDC).⁵

Exclusion Criteria:

Exclude all cases of *S. Typhi* from food handling, healthcare[†] and daycare activities until provision of:

- 3 consecutive negative stool samples collected at least 48 hours apart; AND
- at least 48h after completion of antibiotic treatment (for ciprofloxacin); OR
- at least 2 weeks after completion of antibiotic treatment (for ceftriaxone and azithromycin).⁵

If the patient is treated with another antibiotic or the antibiotic is unknown, discuss with the attending clinician.⁵

If case was treated while traveling and the appropriate medication may not have been prescribed, the case should be referred to a physician for assessment. Sampling should only commence after the appropriate treatment is completed.

Collection of stool samples:

- Submit 3 stool samples at least 48 hours apart. If all 3 samples are negative, end exclusion.
- If any of the 3 samples are positive, continue sampling at least 48 hours apart for a maximum of 3 more samples. If 3 consecutive samples are negative, end exclusion.
- If 3 consecutive negative stool samples (after 6 samples collected) cannot be achieved, the confirmed case is classified as an excreter (see below).⁵

Excreter:

- A confirmed case who continues to excrete *S. Typhi* after 6 stool samples are collected, at least 48h apart, and at least 48h to 2 weeks (see above) after completion of antibiotic treatment to which the pathogen is known to be sensitive.
- If an excreter is identified, an assessment is required to determine the risk of transmitting the pathogen further.⁵

Cases not working in or attending high risk settings:

S. Typhi infections can lead to a carrier state. While no exclusion is necessary, public health should educate *S. Typhi* cases and their physician about the availability of testing to ensure clearance of the organism. Personal hygiene practices should be emphasized.⁵

[†] If the healthcare setting is a hospital, use the “Enteric Diseases Surveillance Protocol for Ontario Hospitals” (OHA and OMA Joint Communicable Diseases Surveillance Protocols Committee, 2017 or as current) for exclusion, available at: <https://www.oha.com/labour-relations-and-human-resources/health-and-safety/communicable-diseases-surveillance-protocols>

6.4 Management of Contacts

Close contacts include any members of a travel party to endemic regions, household members, and sexual partners.

Investigate close contacts:

- Note any symptoms, onset and severity.
- Determine susceptibility of contact including immune status, medical status and other risk factors.
- Identify those involved in high risk activities or settings.

These contacts should be seen by their health care providers and screened for illness.

Symptomatic Contact:

Exclude symptomatic contacts from food handling, healthcare* and daycare activities until provision of:

- 2 consecutive negative stool samples collected at least 48h apart,
- If any sample is positive, exclude as per confirmed case.⁵

Asymptomatic Contact:

- Exclusion of an asymptomatic contact who traveled with a case from food handling, healthcare*, and daycare activities until 2 negative stool samples taken at least 48h apart.
- No exclusion required for asymptomatic contacts who did not travel with a case. (If the source of illness in the case is unclear, consider testing contacts to identify the source.)⁵

6.5 Management of Outbreaks

Please see the *Infectious Diseases Protocol, 2018* (or as current) for the public health management of outbreaks or clusters in order to identify the source of illness, manage the outbreak and limit secondary spread.

Two or more cases linked by time, common exposure, and/or place are suggestive of an outbreak.

For more information regarding specimen collection and testing, please see the Public Health Inspector's Guide to the Environmental Microbiology Laboratory Testing (2017, or as current).⁶

Refer to Ontario's Foodborne Illness Outbreak Response Protocol (ON-FIORP) 2013 (or as current) for multi-jurisdictional foodborne outbreaks which require the response of more than two Parties (as defined in ON-FIORP) to carry out an investigation.

<http://health.gov.on.ca/en/pro/programs/publichealth/enviro/>

7.0 References

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2. Heymann DL, editor. Control of Communicable Diseases Manual. 20 ed. Washington, D.C: American Public Health Association; 2015.
 3. Government of Canada. Typhoid fever [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2016 [updated April 27, 2018. Available from: https://travel.gc.ca/travelling/health-safety/diseases/typhoid?_ga=2.104946243.1393773438.1519131816-547840325.1506102557
 4. Health Protection and Promotion Act, R.S.O. 1990, Reg. 569, Reports, (2018). Available from: <https://www.ontario.ca/laws/regulation/900569>
 5. BC Centre for Disease Control. Communicable Disease Control - Enteric Cases and their Contacts: Exclusion from High Risk Settings (May 2013). Vancouver, BC: Provincial Health Services Authority; 2013. Available from: <http://www.bccdc.ca/health-professionals/clinical-resources/communicable-disease-control-manual/communicable-disease-control>
 6. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Public Health Inspector’s Guide to Environmental Microbiology Laboratory Testing. 5th ed. Toronto, ON: Queen’s Printer for Ontario; 2017. Available from: <https://www.publichealthontario.ca/en/ServicesAndTools/LaboratoryServices/Pages/PHIGuide.aspx>

8.0 Document History

Table 1: History of Revisions

Revision Date	Document Section	Description of Revisions
March 2017	General	New Template
March 2017	6.3 Management of Cases	“Enteric Diseases Surveillance Protocol for Ontario Hospitals” reference updated
March 2017	7.0 References	Updated
March 2017	8.0 Additional Resources	Updated
March 2017	9.0 Document History	Updated

Revision Date	Document Section	Description of Revisions
February 2019	General	Minor revisions were made to support the regulation change to Diseases of Public Health Significance. Common text included in all Disease Specific chapters: Surveillance Case Definition, Outbreak Case Definition, Diagnosis, Reporting Requirements, Management of Cases, and Management of Outbreaks. The epidemiology section and references were updated and Section 8.0 Additional Resources was deleted.
February 2019	3.1 Clinical Presentation	Entire section revised.
February 2019	4.3 Modes of Transmission	Third sentence added: "Sexual transmission of typhoid fever from an asymptomatic carrier has been documented." Last sentence added: "Flies may act as vectors."
February 2019	4.5 Period of Communicability	Entire section revised. Removed overlap with reservoir section.

