

Appendix A: Disease-Specific Chapters

Chapter: Typhoid Fever

Revised March 2017

Typhoid Fever

☒ Communicable

☐ Virulent

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

1.0 Aetiologic Agent

Typhoid fever is caused by the Gram negative bacillus known as *Salmonella enterica* subspecies *enterica* serotype Typhi (commonly *S. Typhi*).¹

2.0 Case Definition

2.1 Surveillance Case Definition

[See Appendix B](#)

2.2 Outbreak Case Definition

Outbreak case definition varies with the outbreak under investigation. For example, confirmed outbreak cases should at a minimum meet the criteria specified for the provincial surveillance confirmed case classification. Consideration should be given to the following when establishing an outbreak case definition:

- Clinical, laboratory and/or epidemiological criteria
- The time frame for occurrence;
- The geographic location(s) or place(s) where cases live or became ill/exposed;
- Special attributes of cases (e.g., age, underlying conditions) and/or aetiologic agent; and
- Further laboratory subtyping (e.g., phage typing, pulsed-field gel electrophoresis) as appropriate which may be used to support linkage.

Cases may be classified by levels of probability (i.e. confirmed, probable and/or suspect).

3.0 Identification

3.1 Clinical Presentation

The clinical presentation of typhoid fever is highly variable, ranging from fever with little other morbidity to sepsis and complications involving many body systems. A typical

case of acute non-complicated typhoid fever is associated with prolonged low-grade fever, and may have any of the following: dull frontal headache, malaise, myalgia, a dry bronchitic cough, anorexia, nausea and abdominal discomfort. Constipation is more common than diarrhea in adults but diarrhea is more common in children and those with HIV. In up to 25% of fair-skinned people small erythematous maculopapular lesions (rose spots) on the trunk are seen in the first week of fever. More severe symptoms include confusion and delirium.^{2, 3}

3.2 Diagnosis

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

S. Typhi can be isolated from blood early in the disease and from urine and feces after the first week of illness.⁴

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>

4.0 Epidemiology

4.1 Occurrence

Worldwide.⁴ 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. Over the last five years, the number of cases of typhoid fever has gradually increased, which may reflect the growing number of Ontarians travelling to endemic regions.

Between 2007 and 2011, an average of 91 cases of typhoid fever were reported per year in Ontario.

Please refer to the Public Health Ontario Monthly Infectious Diseases Surveillance Reports and other infectious diseases reports for more information on disease trends in Ontario.^{5, 6}

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

4.2 Reservoir

Humans; family contacts may be transient or permanent carriers. A carrier state may follow acute illness, mild illness, or even sub-clinical infections. 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.⁴

4.3 Modes of Transmission

Fecal-oral route. Ingestion of food and water contaminated by feces and urine of patients and carriers. Common vehicles include contaminated water and beverages made with contaminated water, shellfish, particularly oysters, milk, ice-cream, raw fruit and vegetables grown in fields fertilized with sewage.^{4, 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. Risk of transmission increases by not using soap for washing hands and poor sanitation.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.⁴

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.⁴ About 10% of untreated typhoid fever cases have detectable bacteria in their stool for three months after onset of symptoms; 2-5% become chronic carriers (carriage for more than one year following illness). The frequency of long-term carriage is higher for women, those older than 50 years, and patients with cholelithiasis, carcinoma of the gall bladder, other gastrointestinal malignancies, persons with biliary abnormalities, or concurrent bladder infection with *Schistosoma haematobium*.² In cases treated with appropriate antibiotics, fewer than 2% become carriers or relapse.³

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.⁴

5.0 Reporting Requirements

5.1 To local Board of Health

Individuals who have or may have typhoid fever shall be reported as soon as possible to the medical officer of health by persons required to do so under the *Health Protection and Promotion Act*, R.S.O. 1990. (HPPA).⁷

5.2 To the Ministry of Health and Long-Term Care (the ministry) or Public Health Ontario (PHO), as specified by the ministry

Report only case classifications specified in the case definition. Cases shall be reported using the integrated Public Health Information System (iPHIS), or any other method specified by the ministry **within five (5) business days of receipt of initial notification** as per iPHIS Bulletin Number 17: Timely Entry of Cases.⁸

The minimum data elements to be reported for each case are specified in the following:

- The HPPA, *Ontario Regulation 569* (Reports),^{9, 7}
- 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.
- Travellers should be referred to travel clinics to assess their personal risk and appropriate preventive measures.

For more food safety prevention measures, please see the ministry'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.⁴

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

Refer to Public Health Ontario's website at www.publichealthontario.ca to search for the most up-to-date Provincial Infectious Diseases Advisory Committee (PIDAC) best practices on Infection Prevention and Control (IPAC). PIDAC best practice documents can be found at:

http://www.publichealthontario.ca/en/BrowseByTopic/InfectiousDiseases/PIDAC/Pages/PIDAC_Documents.aspx.

6.3 Management of Cases

Investigate cases of typhoid fever to determine the source of infection. Refer to Section 5: Reporting Requirements above for relevant data to be collected during case investigation. In addition to the requirements of HPPA *Regulation 569* (Reports),^{9, 7} the following disease-specific information should also be obtained during the incubation period:

- Symptoms and date of symptom onset
- 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 travellers to endemic country
- History of occupation involving vulnerable populations, food handling, childcare and healthcare
- 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).¹⁰

Exclusion Criteria:¹⁰

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).

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

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.

* 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, revised December 2015, or as current) for exclusion criteria.

<http://www.oha.com/Services/HealthSafety/Pages/CommunicableDiseasesSurveillanceProtocols.aspx>

Collection of stool samples:

1. Submit 3 stool samples at least 48 hours apart. If all 3 samples are negative, end exclusion.
2. 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.
3. If 3 consecutive negative stool samples (after 6 samples collected) cannot be achieved, the confirmed case is classified as an excreter (see below).

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.

Exclusion for 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.

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:¹⁰

- 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.

Exclude asymptomatic contacts *who traveled with a case from food handling, healthcare* and daycare activities* until provision of 2 consecutive 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.)

* 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, revised December 2015, or as current) for exclusion criteria:

<http://www.oha.com/Services/HealthSafety/Pages/CommunicableDiseasesSurveillanceProtocols.aspx>

6.5 Management of Outbreaks

Provide public health management of outbreaks or clusters in order to identify the source of illness, stop the outbreak and limit secondary spread.

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

As per this Protocol, outbreak management shall be comprised of, but not 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.

Refer to Ontario's Foodborne Illness Outbreak Response Protocol (ON-FIORP) at <http://health.gov.on.ca/en/pro/programs/publichealth/enviro/> for multi-jurisdictional foodborne outbreaks which require the response of more than two Parties (as defined in ON-FIORP) to carry out an investigation.

For more information regarding specimen collection and testing refer to **the Public Health Inspector's Guide to the Principles and Practices of Environmental Microbiology**, available at:

<https://www.publichealthontario.ca/en/About/Newsroom/Pages/New-Public-Health-Inspectors-Guide-Released.aspx>.

7.0 References

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8.0 Additional Resources

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9.0 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

