Ministry of Health

Ontario Public Health Standards:
Requirements for Programs, Services and Accountability

Infectious Disease Protocol

Appendix 1: Case Definitions and Disease-Specific Information

Disease: Salmonellosis

Effective: August 2023

Ontario

Salmonellosis

☒ Communicable
☐ Virulent

Health Protection and Promotion Act (HPPA)[1]
Ontario Regulation (O. Reg.) 135/18 (Designation of Diseases)[2]

Provincial Reporting Requirements

☒ Confirmed case
☒ Probable case

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:

- O. Reg. 569 (Reports) under the HPPA;
- The iPHIS User Guides published by Public Health Ontario (PHO); and
- Bulletins and directives issued by PHO.[3,4]

Type of Surveillance

Case-by-case

Case Definition

Confirmed Case

Laboratory confirmation of infection with or without clinically compatible signs and symptoms:

- Isolation of *Salmonella* spp. (excluding *Salmonella* Typhi or Paratyphi) by culture from an appropriate clinical specimen (e.g., blood, stool, rectal swab, urine, or sterile site specimen)

Probable Case

- Clinically compatible signs and symptoms in a person with an epidemiologic link to a laboratory-confirmed case

OR

Supportive laboratory evidence of *Salmonella* spp. infection (with or without clinically compatible signs and symptoms):

- Detection of nontyphoidal *Salmonella* spp. (excluding *Salmonella* Typhi or Paratyphi) nucleic acids by molecular methods (e.g., polymerase chain reaction) from an appropriate clinical specimen.

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.[3]

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).

Clinical Information

Clinical Evidence

Clinically compatible signs and symptoms are characterized by diarrhea, abdominal pain, nausea, headache, fever, and sometimes vomiting. Asymptomatic infections may occur, and the organism may rarely cause extraintestinal infections (e.g., bloodstream, endovascular, osteoarticular, neurological, genitourinary, visceral, or pulmonary infections).

Clinical Presentation

Nontyphoidal salmonellosis commonly manifests as sudden onset of diarrhea (less commonly bloody), abdominal pain, fever, nausea, and vomiting.[5,6] The illness

usually lasts 4 to 7 days, and most individuals recover without treatment.[7,8] Diarrhea may lead to dehydration, which can be severe among the very young, the elderly and those with an impaired immune system.[5-7] Severity of the disease is related to serotype, number of organisms ingested and host factors; severity can be increased when the organism is resistant to antimicrobial agents used to treat the patient.[5]

In < 5% of cases, nontyphoidal salmonellosis can spread to blood, bones, joints, urine, nervous system, or other internal organs causing symptoms related to that part of the body or system. These extraintestinal infections can have long-term effects, and may be severe or fatal.[7] Death is uncommon, except among the very young, the elderly, and the immunosuppressed.[5,7]

Laboratory Evidence

Laboratory Confirmation

- Isolation of nontyphoidal *Salmonella* spp. (excluding *Salmonella* Typhi or Paratyphi) by culture from an appropriate clinical specimen (e.g., blood, stool, rectal swab, urine, or sterile site specimen).

Supportive Laboratory Evidence of Infection

- Detection of nontyphoidal *Salmonella* spp. (excluding *Salmonella* Typhi or Paratyphi) nucleic acids by molecular methods (e.g., polymerase chain reaction) from an appropriate clinical specimen.

Indications and Limitations

- Culture is required for optimal public health management. Sites performing testing for *Salmonella* spp. by molecular methods should reflex any positive molecular finding to culture for appropriate isolation of the organism.
- All cultured *Salmonella* spp. isolates should be sent as soon as possible to PHO's laboratory for routine serotyping and subtyping surveillance (e.g., whole genome sequencing).
- Molecular methods for *Salmonella* spp. have superior sensitivity compared to traditional culture methods. However, potential cross-reactivity, co-infection, horizontal gene transfer, or loss of gene target may not be able to be ruled

out solely based on molecular test results.

For further information about human diagnostic testing, contact PHO's laboratory.

Case Management

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.[3] Refer to Provincial Reporting Requirements above for relevant data to be collected during case investigation.

In addition, the following disease-specific information may also be collected:

- Food consumed and exposure to animals, animal feed/pet treats, or recreational water for the 7-day period prior to symptom onset;
- Known exposure to a person with clinical signs and symptoms compatible with nontyphoidal salmonellosis;
- History of occupation or activities involving vulnerable populations, food handling, childcare, and healthcare; and
- History of visits to farms, petting zoos, zoos, and travelling animal shows.

If available, collect and test suspected food items and prevent further consumption by recalling, holding, or otherwise disposing of the suspected items. Please see the Outbreak Management section for more information.

Provide education about transmission of infection and prevention via proper hand hygiene and safe food handling.

Investigators should also note any treatment prescribed including name of the medication, dose, duration of treatment and start and finish dates.

Decisions regarding the treatment of individual cases are at the discretion of the attending clinician. For uncomplicated gastroenteritis, treatment is generally supportive (e.g., rehydration and electrolyte replacement).[5] Evidence suggests that antibiotic therapy does not shorten the duration of the disease. It can prolong the duration of fecal excretion, may not eliminate the carrier state, and may lead to

resistant strains or more severe infections.[9-11] Antibiotic treatment may be considered for certain groups, including infants up to 2 months, the elderly, the debilitated, those with sickle cell disease, persons with HIV, or patients with continued high fever or manifestations of extra-intestinal infection.[5,6]

Emergence of multidrug resistant (MDR) *Salmonella* Newport associated with travel to Mexico has been reported in the US since 2018 and in Ontario since 2022.[13] The US noted that many travelers with MDR *Salmonella* Newport infections also reported eating beef, cheese (including queso fresco and Oaxaca), beef jerky, or dried beef (carne seca) in Mexico.[14] Further information on treatment guidance for individuals at risk of MDR *Salmonella* Newport following travel to Mexico is available from the Committee to Advise on Tropical Medicine and Travel (CATMAT).[15]

Exclusion criteria for symptomatic cases (confirmed and probable):

- Symptomatic individuals from food handling, attending or working in day nurseries, direct care of infants, elderly, immunocompromised and institutionalized patients until being symptom-free for 24 hours, or symptom-free for 48 hours after discontinuing use of anti-diarrheal medication.
- The rationale for exclusion for 48 hours after discontinuing anti-diarrheal medication is to ensure that diarrhea does not return after the anti-diarrheal medication has been discontinued. In the event that antibiotics are used, the person should be excluded until symptom-free for 24 hours.

If the case is working in 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 criteria.[16]

Exclusion considerations for asymptomatic food handlers with laboratory confirmation of nontyphoidal salmonellosis:

- Consider the need for work exclusion based on an assessment of the potential risk of food contamination in the context of the following factors:
    - The anticipated compliance of the affected food handler and the food premise operator(s) with:
        - Safe food handling practices
        - Appropriate hand hygiene practices

- The nature of the specific food handling duties, the type of food items being prepared (e.g., preparing ready-to-eat foods with multiple ingredients may require more food handling, and handling unpackaged food to be consumed without further processing).
- Preparing food for a population with risk factors for severe disease and complications, such as the very young, elderly and immunocompromised.
- Reassignment to low-risk activities (e.g., no direct contact with food or patient care) may be considered an alternative to exclusion.

There is no specified time period for work exclusion of asymptomatic food handlers with laboratory confirmation of nontyphoidal salmonellosis. Work exclusion should include conditions for a return to regular duties and should be based on a risk assessment.

Contact Management

Consider household members as close contacts of a case. Provide education about transmission of infection and proper hand hygiene.

Symptomatic contacts that work in high-risk settings should be assessed by their health care provider to determine if infected and should be excluded as specified for cases.

Outbreak Management

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.[3]

Two or more cases linked by time, common exposure, and/or place is 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 (2021, or as current).[17]

Refer to Ontario's Foodborne Illness Outbreak Response Protocol (ON-FIORP) 2020 (or as current) for multi-jurisdictional foodborne outbreaks which require the response of more than two Partners (as defined in ON-FIORP) to carry out an investigation.[18]

Prevention and Control Measures

Personal Prevention Measures

Preventive measures:[5]

- Minimize cross-contamination by washing (wash, rinse, and sanitize) cutting boards and utensils with warm soapy water after contact with raw poultry, and avoiding contact between fruits, vegetables, and ready-to-eat foods with the juices of raw poultry.
- Practice good hand hygiene: after using sanitary facilities, after assisting others with personal care (e.g., diapering or toileting), after touching or handling pets and other animals, and before, during, and after food handling.
- Ensure thorough cooking and safe handling of meats. For proper cooking temperatures, see the ministry's publication "Food Safety: Cook".[19]
- Follow manufacturer's directions for cooking and re-heating of high-risk food items (such as raw or frozen poultry and processed poultry products).
- For high-risk individuals, avoid consuming raw sprouts of any kind.
- Avoid preparing or serving food while ill.
- Treat or boil non-potable water intended for consumption.
- Avoid consuming raw or undercooked eggs and dirty or cracked eggs. Use pasteurized eggs or egg products in recipes that call for or may result in the consumption of raw or undercooked eggs (e.g., Hollandaise sauce).
- Avoid consuming raw or unpasteurized milk and unpasteurized milk products.
- Limit storage of hazardous food at room temperature to a maximum of 2 hours.

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

"Frequently Asked Questions".[20]

Infection Prevention and Control Strategies

Strategies:

- Educate food handlers and the general public about the importance of hand hygiene before, during, and after food preparation; thorough cooking of all foods; proper food handling and storage especially avoiding cross-contamination between raw and cooked foods; maintaining a sanitary kitchen.[5]
- Implement routine practices and contact precautions for incontinent and diapered cases.[6]
- Refer to PHO's website at https://www.publichealthontario.ca/en/Health-Topics/Infection-Prevention-Control to search for the most up-to-date information on Infection Prevention and Control.

Disease Characteristics

Aetiologic Agent – Nontyphoidal salmonellosis is caused by a bacteria of the genus *Salmonella* within the *Enterobacteriaceae* family.[5,6] The genus *Salmonella* includes two species: *S. enterica* and *S. bongori*. *S. enterica* can be further differentiated into six subspecies, *S. enterica* subsp. *enterica*, *S. enterica* subsp. *salamae*, *S. enterica* subsp. *arizonae*, *S. enterica* subsp. *diarizonae*, *S. enterica* subsp. *houtenae,* and *S. enterica* subsp. *indica*. Overall, 99% of human infections are caused by *S. enterica* subsp. *enterica*, with the remaining five subspecies and *S. bongori* representing rare human cases from environmental or cold-blooded animal reservoirs. Serotyping has been historically established to provide further differentiation resolution, with over 2,500 unique serotypes reported to date among the *Salmonella* genus of which about 1,500 belong to *S. enterica* subsp. *enterica*. Serotype nomenclature is internationally standardized using the White-Kauffman-Le Minor scheme. Due to their unique epidemiological and clinical considerations, the serotypes Typhi, Paratyphi A, Paratyphi B, and Paratyphi C are usually grouped as the "typhoidal" *Salmonella* and distinguished from all other *Salmonella* serotypes termed "nontyphoidal".

Modes of Transmission – Depending on subspecies and serotype*, Salmonella* bacteria may reside in the intestines of humans and other animals, including poultry and other birds.[7,8] Infection is acquired by direct or indirect contact with infected animals or their environment.[5,8]

The predominant mode of transmission is through the ingestion of contaminated food, often times of animal origin. The most common food sources include raw and undercooked poultry and poultry products, unpasteurized/raw milk and milk products, eggs, meat and meat products, processed foods, and produce.[5,7,8] *Salmonella* has also been found in pet food and treats.[5,8]

Contaminated water is also an important mode of transmission, especially in areas where drinking water supplies are not disinfected.[5]

Fecal-oral transmission from person-to-person has also been observed when diarrhea is present, especially in institutional settings. Infants and stool incontinent adults pose a greater risk of transmission than do asymptomatic carriers.[5]

The infectious dose varies by host (e.g., susceptibility), environment (e.g. food matrix), and bacterium (e.g. serotype) factors. It usually follows a dose response, with reported infections with as few as 100 organisms.[21]

Incubation Period - From 6 hours to 7 days, usually about 12-36 hours. Longer incubation periods of up to 16 days have been documented and may not be uncommon following low-dose ingestion.[22-25]

Period of Communicability - The period of communicability extends throughout the course of infection and carriage, which usually persists for 3 to 4 weeks. A temporary carrier state may continue for months, especially in infants. Depending on the serotype, approximately 1% of infected adults and 5% of children younger than 5 years, may excrete the organism for at least 1 year.[5] Short courses of antimicrobial therapy can prolong excretion.[9]

Reservoir - Domestic and wild animals, including poultry (e.g., chickens, especially chicks, turkeys, geese, ducks), reptiles (e.g., turtles, iguanas, snakes), amphibians (e.g., frogs, toads), swine, cattle, small ruminants, rodents (e.g., hamsters, rats, mice), pets (e.g., dogs, cats, hedgehogs),[5,6,8] humans infected with *Salmonella* bacteria and convalescent carriers.[5,8]

Host Susceptibility and Resistance - Susceptibility is universal and increased by achlorhydria, antacid treatment, asplenia, gastrointestinal surgery, prior or current antibiotic therapy, neoplastic disease, and other immunosuppressive conditions, including malnutrition. A higher inoculum of ingested bacteria leads to a higher risk of severe or prolonged symptoms. Immunosuppressed patients, infants, and the elderly are at increased risk for invasive infection.[5]

Please refer to PHO's Infectious Disease Trends in Ontario (IDTO) interactive tool for the most up-to-date information on infectious disease trends in Ontario.[26]

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

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Document History

Revision Date	Document Section	Description of Revisions
April 2022	Entire Document	New template. Appendix A and B merged. No material content changes.
April 2022	Epidemiology: Occurrence section	Removed.
April 2022	ICD Codes	Removed.
August 2023	Disease Characteristics	Updated incubation period to reflect current evidence
August 2023	Laboratory Evidence	Addition of whole genome sequencing and removal of phage typing and PFGE under 'Indications and Limitations'

Revision Date	Document Section	Description of Revisions
August 2023	Case Management	Information on MDR *Salmonella* Newport
August 2023	Prevention and Control measures	Updated wording