Salmonellosis

☒ 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

Salmonellosis is caused by the bacterium, Salmonella, a Gram-negative, non-spore forming bacillus that has over 2,500 serotypes, belonging to the Enterobacteriaceae family.\(^1\) \(^2\)

Nomenclature for Salmonella is Salmonella enterica subsp enterica. Serotypes include Typhimurium, Enteriditis, etc.\(^1\)

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 and/or epidemiological criteria;
- The time frame of 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
- Further strain typing (e.g. serotype, phage type (PT), pulsed field gel electrophoresis (PFGE)) 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

Salmonellosis causes a spectrum of illness ranging from asymptomatic gastrointestinal tract carriage to gastroenteritis, bacteremia and focal infections.\(^1\) \(^2\) Symptoms can occur within 6-72 hours, however usually appear 12-36 hours after exposure. Symptoms include sudden onset of headache, fever, abdominal pain, diarrhea, nausea and sometimes vomiting. Some
infected individuals may experience bloody diarrhea. Dehydration, especially among the young, the elderly and those with impaired immune systems can be severe, and may result in hospitalization. Reactive arthritis is a recognized sequela of salmonellosis. Death is uncommon. Foodborne *Salmonella* infection can lead to urinary tract infection, particularly among elderly women. This is generally caused either by self-contamination of the urinary tract due to improper wiping or as a result of bacteremia.

### 3.2 Diagnosis

See Appendix B for diagnostic criteria relevant to the Case Definition.

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](http://www.publichealthontario.ca/en/ServicesAndTools/LaboratoryServices/Pages/default.aspx)

### 4.0 Epidemiology

#### 4.1 Occurrence

Salmonellosis is the second most common enteric infection in Ontario. The number of cases typically peaks in the summer months. *S. Enteritidis*, *S. Typhimurium* and *S. Heidelberg* are the three most common serotypes in Ontario.

Between 2007 and 2011, an average of 2,564 cases per year of salmonellosis was reported in Ontario.

Please refer to the Public Health Ontario (PHO) Monthly Infectious Diseases Surveillance Reports and other infectious diseases reports for more information on disease trends in Ontario.

[http://www.publichealthontario.ca/en/DataAndAnalytics/Pages/DataReports.aspx](http://www.publichealthontario.ca/en/DataAndAnalytics/Pages/DataReports.aspx)

Occurrence is worldwide. It is estimated that only 1% of all infections are ever clinically recognized. The incidence rate of infection is highest among infants and young children. About 60-80% of all cases occur sporadically. Large outbreaks in hospitals, institutions for children, restaurants, nursing homes and the community are common. Outbreaks usually arise from food contaminated at source or during handling by an ill person or carrier, although person-to-person transmission can occur.

#### 4.2 Reservoir

Domestic and wild animals, including poultry, swine, cattle, rodents, and pets such as iguanas, tortoises, turtles, terrapins, chicks and other baby poultry, dogs, cats, hamsters, hedgehogs, amphibians, lizards, snakes, frogs, toads, newts and salamanders.

Acute cases, convalescent carriers and mild and unrecognized cases constitute an important source of illness.
4.3 Modes of Transmission
Most types of *Salmonella* live in the intestines of animals and birds. Infection is acquired by the ingestion of organisms in food contaminated by the stool of an infected animal or person.

The most common food vehicles include poultry and poultry products (e.g. raw/undercooked chicken nuggets), raw milk and raw milk products, contaminated water, meat and meat products, raw/undercooked eggs and egg products, and raw fruits and vegetables.

Raw alfalfa sprouts, raw mung bean sprouts, and spicy sprouts have been linked to a number of outbreaks in Canada and the United States.\(^9,10\)

In addition to the animals identified in the ‘Reservoir’ section above, *Salmonella* has recently been found in pet foods and was associated with a multistate wide outbreak in the US and UK.\(^11,12\)

Fecal-oral transmission from person-to-person has also been observed when diarrhea is present, especially in institutional settings.\(^5\) Infants and stool incontinent adults pose a greater risk of transmission than do asymptomatic carriers.\(^1\)

4.4 Incubation Period
From 6-72 hours, usually about 12-36 hours.\(^1\) Longer incubation periods of up to 16 days have been documented, and may not be uncommon following low-dose ingestion.\(^1,13\)

4.5 Period of Communicability
The median duration of fecal shedding of non-typhoidal *Salmonella* after intestinal infection has been estimated as 1 month in adults and 7 weeks in children under 5 years of age.\(^14\) In one study, 45% of children under 5 years continued to shed *Salmonella* organisms 12 weeks after infection, compared to only 5% of older children and adults.\(^2\) Antibiotic usage may also prolong the duration of fecal shedding,\(^1,2\) but human carriage of non-typhoidal *Salmonella* species beyond one year is rare.\(^1,15\)

4.6 Host Susceptibility and Resistance
Susceptibility is general and usually increased by achlorhydria, antacid treatment, gastrointestinal surgery, prior or current broad-spectrum antibiotic therapy, neoplastic disease, and other immunosuppressive conditions including malnutrition.\(^1\)

5.0 Reporting Requirements

5.1 To local Board of Health
Individuals who have or may have salmonellosis 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).\(^16\)

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 using the integrated Public Health Information System (iPHIS), or any other method specified by the ministry within
one (1) business day of receipt of initial notification as per iPHIS Bulletin Number 17: Timely Entry of Cases.\textsuperscript{17}

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

- \textit{Ontario Regulation 569} (Reports) under the HPPA,\textsuperscript{18, 16}
- The iPHIS User Guides published by PHO; and
- Bulletins and directives issued by PHO.

\section*{6.0 Prevention and Control Measures}

\subsection*{6.1 Personal Prevention Measures}

Preventive measures:\textsuperscript{1}

- Minimize cross-contamination through the use of safe food handling techniques.
- Practice good hand hygiene after using sanitary facilities, after assisting others with personal care (e.g. diapering or toileting), after handling raw foods, pets and other animals, and before food handling.
- Cook and reheat food thoroughly to the appropriate temperatures. For temperatures, see the ministry’s publication “Food Safety: Cook” available at \url{http://www.health.gov.on.ca/en/public/programs/publichealth/foodsafety/cook.aspx#4}
- 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.
- Avoid preparing or serving food while ill.
- Treat or boil water intended for consumption.
- Avoid drinking raw or unpasteurized milk. For children, older adults, pregnant women and the immunocompromised, avoid consuming dairy products made from unpasteurized or raw milk.
- Keep storage of hazardous food at room temperature for no more than 2 hours.
- For more food safety prevention measures, please see the ministry’s food safety frequently asked questions available from \url{http://www.health.gov.on.ca/en/public/programs/publichealth/foodsafety/faq.aspx}
6.2 Infection Prevention and Control Strategies

Strategies:

- Educate food handlers and the general public about the importance of hand washing before, during and after food preparation; proper food handling and storage especially avoiding cross contamination between raw and cooked foods; maintaining a sanitary kitchen.\(^1\)

- Implement routine practices and contact precautions for incontinent and diapered cases.\(^2\)

Refer to Public Health Ontario’s website at [www.publichealthontario.ca](http://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](http://www.publichealthontario.ca/en/BrowseByTopic/InfectiousDiseases/PIDAC/Pages/PIDAC_Documents.aspx).

6.3 Management of Cases

Investigate cases of salmonellosis 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),\(^16,\,18\) the following disease-specific information should also be obtained during the three day incubation period (or if asymptomatic, use date of specimen collection in place of onset date):

- Symptoms and date of symptom onset;
- Food consumed and exposure to animals, animal feed/ pet treats or recreational water for the 3 day period prior to gastrointestinal symptom onset;
- Known exposure to a carrier or person with clinical signs and symptoms compatible with 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.

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

Decisions regarding treatment of individual cases are at the discretion of the attending clinician. For uncomplicated enterocolitis, treatment is generally supportive (e.g., rehydration and electrolyte replacement as needed).\(^1\) Evidence suggests that antibiotic therapy does not shorten the duration of disease, can prolong the duration of fecal excretion, may not eliminate the carrier state, and may lead to resistant strains or more severe infections.\(^19-22\) 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 extraintestinal infection.\(^1,\,2\)
If available, collect and test suspected food items and prevent further consumption by recalling, holding or otherwise disposing of the suspected items. Please see ‘Management of Outbreaks’ section for more information.

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

**Exclusion criteria for symptomatic cases (confirmed and probable):**

- Exclude symptomatic individuals from food handling, from attending or working in day nurseries, from direct care of infants, elderly, immunocompromised and institutionalized patients until 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 the use of 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, February 2014) for exclusion criteria: [http://www.oha.com/Services/HealthSafety/Documents/Enteric%20Diseases%20Revised%20February%202014.pdf](http://www.oha.com/Services/HealthSafety/Documents/Enteric%20Diseases%20Revised%20February%202014.pdf)*

**Exclusion considerations for asymptomatic food handlers with laboratory confirmation of salmonellosis (see Appendix B for appropriate clinical specimens):**

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

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

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.

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. These definitions should be reviewed during the course of the outbreak, and modified if necessary, to ensure that the majority of cases are captured by the definitions;
- 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;
- Identify the origin of suspect food, along with the transportation, storage and preparation processes;
- Coordinate and collect appropriate clinical, environmental and/or food 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) for multi-jurisdictional foodborne outbreaks which require the response of more than two Parties (as defined in ON-FIORP) to carry out an investigation.

7.0 References


11. Centre for Disease Control and Prevention [Internet]. Atlanta, GA: CDC; 2010. Investigation announcement: multistate outbreak of human Salmonella enteritidis infections linked to alfalfa sprouts and spicy sprouts; [updated 2011 June 28; cited 2014


### 8.0 Additional Resources


### 9.0 Document History

#### Table 1: History of Revisions

<table>
<thead>
<tr>
<th>Revision Date</th>
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<tbody>
<tr>
<td>December 2014</td>
<td>General</td>
<td>New template.</td>
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<tr>
<td></td>
<td></td>
<td>Title of Section 4.6 changed from “Susceptibility and Resistance” to “Host Susceptibility and Resistance”.</td>
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<td>Title of Section 5.2 changed from “To Public Health Division (PHD)” to “To the Ministry of Health and Long-Term Care (the ministry) or Public Health Ontario (PHO), as specified by the ministry”.</td>
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<tr>
<td>December 2014</td>
<td>Section 9.0 Document History</td>
<td>added.</td>
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</table>
| December 2014 | 1.0 Aetiologic Agent     | First paragraph, “…bacillus that has more than 2,000 serotypes…” changed to “bacillus that has over 2,500 serotypes…”  
Second paragraph, removal of “new”.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| December 2014 | 2.1 Outbreak Case        | First paragraph, addition of second sentence  
“For example, confirmed outbreak cases should at a minimum meet the criteria specified for the provincial surveillance confirmed case classification.”  
Numbers converted into bullets for all points.  
Bullet 1, removal of “laboratory”.  
Addition of a fifth bullet “Further strain typing (e.g. serotype, phage type (PT), pulsed field gel electrophoresis (PFGE)) as appropriate, which may be used to support linkage.”                                                                                                                                                                                                                                                                                                                                                   |
| December 2014 | 3.1 Clinical Presentation| First paragraph, addition of first sentence  
“Salmonellosis causes a spectrum of illness ranging from asymptomatic gastrointestinal tract carriage to gastroenteritis, bacteremia and focal infections.”  
First paragraph, “…after consumption of contaminated food or beverage” changed to “…after exposure.”  
First paragraph, addition of new third sentence, “Some infected individuals may experience bloody diarrhea.”  
First paragraph, “resulting in…” replaced with “may result in…”  
First paragraph, removed “In these patients, the infection may spread to the bloodstream; occasionally, the bacteria may localize in any tissue of the body, producing abscesses ad other systemic complications.”  
First paragraph, added “Reactive arthritis is a recognized sequela of salmonellosis.”  
First paragraph, removed “…except in the very old, the very young, and in persons with compromised immune systems.” |
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<tr>
<td>December 2014</td>
<td>3.2 Diagnosis</td>
<td>Added a second paragraph, “Foodborne <em>Salmonella</em> infection can lead to urinary tract infection, particularly among elderly women. This is generally caused either by self-contamination of the urinary tract due to improper wiping or as a result of bacteremia.”</td>
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<tr>
<td>December 2014</td>
<td>3.2 Diagnosis</td>
<td>First paragraph, addition of “for diagnostic criteria relevant to the Case Definition.” Removal of second paragraph “Diagnosis is made through the isolation of <em>Salmonella</em> organisms from stool, rectal swabs, urine, blood or any other sterile site.” Addition of new second paragraph “For further information about human diagnostic testing, contact the Public Health Ontario Laboratories or refer to the Public Health Ontario Laboratory Services webpage…”</td>
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<tr>
<td>December 2014</td>
<td>4.1 Occurrence</td>
<td>Entire section revised.</td>
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<tr>
<td>December 2014</td>
<td>4.2 Reservoir</td>
<td>First paragraph, addition of “baby poultry, hamsters, hedgehogs, amphibians, lizards, toads, newts and salamanders” to list of domestic and wild animals.</td>
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| December 2014 | 4.3 Modes of Transmission | Second paragraph, addition of “(e.g. raw/undercooked chicken nuggets)”.

Addition of new third paragraph, “Raw alfalfa sprouts, raw mung bean sprouts, and spicy sprouts have been linked to a number of outbreaks in Canada and the United States.” Removal of previous third paragraph. Replaced with new fourth paragraph, “In addition to the animals identified in the ‘Reservoir’ section above, *Salmonella* has recently been found in pet foods and was associated with a multistate wide outbreak in the US and UK.”

Fourth paragraph changed from “Fecal-oral transmission from person-to-person can also occur when diarrhea is present, and can be a concern, especially in institutional settings” to “Fecal-oral transmission from person-to-person has also been observed when diarrhea is present, especially in institutional settings. Infants and
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<td>December 2014</td>
<td>4.4 Incubation Period</td>
<td>Addition of second sentence, “Longer incubation periods of up to 16 days have been documented, and may not be uncommon following low-dose ingestion.”</td>
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<td>December 2014</td>
<td>4.5 Period of Communicability</td>
<td>Entire section revised.</td>
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<tr>
<td>December 2014</td>
<td>5.1 To local Board of Health</td>
<td>First sentence changed from “Confirmed and suspected cases shall be report to the…” to “Individuals who have or may have salmonellosis shall be reported as soon as possible to the…”</td>
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| December 2014  | 5.2 To the Ministry of Health and Long-Term Care (the ministry), or Public Health Ontario (PHO), as specified by the ministry | First paragraph, first sentence, removed “to PHD”.  
Second bullet removed and replaced with “The iPHIS User Guides published by PHO”.  
Third bullet, “the Ministry” replaced with “PHO”. |
| December 2014  | 6.1 Personal Prevention Measures           | First bullet, “…by washing cutting boards and utensils with warm soapy water between uses…” changed to “…through the use of safe food handling techniques.”  
Second bullet, “Wash hands after using sanitary facilities…” changed to “Practice good hand hygiene after using sanitary facilities, after assisting other with personal care (e.g. diapering or toileting), after handling raw foods, pets and other animals, and before food handling.”  
Third bullet, “Thoroughly cook all food derived from animal sources…” changed to “Cook and reheat food thoroughly to the appropriate temperatures. For temperatures, see the ministry’s publication “Food Safety: Cook” available at…”  
New fourth bullet added, “Follow manufacturer’s directions for cooking and re-heating of high-risk food items (such as raw or frozen poultry and processed poultry products).”  
New fifth bullet added, “For high risk
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<td></td>
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<td>individuals, avoid consuming raw sprouts.”</td>
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<td>Eighth bullet, “Consume only pasteurized milk and dairy products made from pasteurized milk” changed to “Avoid drinking raw or unpasteurized milk. For children, older adults, pregnant women and the immunocompromised, avoid consuming dairy products made from unpasteurized or raw milk.”</td>
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<td>Ninth bullet added, “Keep storage of hazardous food at room temperature for no more than 2 hours.”</td>
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<td>Tenth bullet added, “For more food safety prevention measures, please see the ministry’s food safety frequently asked questions available from…”</td>
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<td>Second bullet, removed “for the duration of hospitalization.”</td>
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<td>Added paragraph, “Refer to Public Health Ontario’s website at <a href="http://www.publichealthontario.ca">www.publichealthontario.ca</a> 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…”</td>
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<td>December 2014</td>
<td>6.3 Management of Cases</td>
<td>First paragraph, removed “The following disease-specific information pertaining to the 3 days prior to onset of symptoms should also be obtained during case management”.</td>
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<td>Second paragraph added, “In addition to the requirements of HPPA Regulation 569 (Reports), the following disease-specific information should also be obtained during the three day incubation period (or if asymptomatic, use date of specimen collection in place of onset date)”.</td>
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<td>Second bullet removed, “History of out-of-province or international travel, including earliest and latest exposure dates”.</td>
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|               |                  | New second bullet added, “Food consumed and
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|               | exposure to animals, animal feed/ pet treats or recreational water for the 3 day period prior to gastrointestinal symptom onset”.
|               | New third bullet, “Known exposure to a carrier or person with clinical signs and symptoms compatible with salmonellosis” to replace previous fourth bullet “Known exposure to a carrier or unreported case in the 3 days before symptom onset”.
|               | Fourth bullet, addition of “or activities”.
|               | Fifth bullet, addition of “petting zoos, zoos, and travelling animal shows.”
|               | Third paragraph removed.
|               | Fourth paragraph, changed from “Note any treatment prescribed…” to “Investigators should also note any treatment prescribed including name of medication, dose duration of treatment and start and finish dates.”
|               | Addition of new fifth paragraph, “Decisions regarding treatment of individual cases are at the discretion of the attending clinician. For uncomplicated enterocolitis, treatment is generally supportive (e.g., rehydration and electrolyte replacement as needed). Evidence suggests that antibiotic therapy does not shorten the duration of disease, can prolong the duration of fecal excretion, may not eliminate the carrier state, and may lead to resistant strains or more severe infections. 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 extraintestinal infection.”
|               | Sixth paragraph, addition of “Please see ‘Management of Outbreaks’ section for more information.”
|               | Removed entire seventh paragraph, “If available, collection and test suspected food items and prevention further consumption by recalling…”
<p>|               | Subheading changed from “Exclusion Criteria” |</p>
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<tr>
<td>December 2014</td>
<td>6.4 Management of Contacts</td>
<td>Second paragraph, changed “above” to “specified for cases”.</td>
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| December 2014 | 6.5 Management of Outbreaks | Second paragraph changed from “Two or more unrelated cases of the same serotype of salmonellosis…” to **“Two or more cases linked by time, common exposure, and/or place is suggestive of an outbreak.”**  
Third bullet, addition of “These definitions should be reviewed during the course of the outbreak, and modified if necessary, to ensure that the majority of cases are captured by the definitions”.  
Addition of new eighth bullet, “Identify the origin of suspect food, along with the transportation, storage and preparation processes”.  
Ninth bullet, addition of “environmental and/or food specimens”.  
Addition of new fourth paragraph, “For more information regarding specimen collection and testing, please refer to the Public Health Inspector’s Guide to the Principles and Practices of Environmental Microbiology…” |
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Addition of new fifth paragraph, “Refer to Ontario’s Foodborne Illness Outbreak Response Protocol (ON-FIORP) for multi-jurisdictional foodborne outbreaks which require the response of more than two Parties (as defined in ON-FIORP) to carry out an investigation…”