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2.1 Introduction to Enteric Illness Investigation

When enteric illness is identified (e.g. through laboratory testing or clinical history) in an individual or a cluster of individuals, a comprehensive investigation is carried out. The purpose of this local investigation is to identify the factors that contributed to a person contracting the illness. This investigation will provide the information needed by public health officials to implement appropriate public health measures to prevent further illness.

Investigations are carried out by field investigators who work under the direction of the Regional Medical Officer of Health (RMOH). In Newfoundland and Labrador the routine investigations of food and waterborne illness are completed by Environmental Health Officers (EHO) who work for the Government Service Centre (GSC), Department of Government Services. In some situations the Public Health Nurse or Infection Control Practitioner may be asked to participate in field investigations, such as when an outbreak occurs in a healthcare facility.

Part 1: Single Case Investigation

Single cases of enteric illness should be investigated thoroughly by investigators. The information obtained from single cases could be important in preventing the case from suffering similar illness in the future, preventing others from becoming ill and identifying enteric illness outbreaks.

To ensure that information is collected consistently throughout the province, the Food/Water/Enteric Illness Questionnaire (Appendix A) has been developed for use by investigators of single cases of enteric illness. The questionnaire has been adapted from forms C1 and C2 of the Procedures to Investigate Foodborne Illness, IAFP, 5th Edition, 2007.

Upon completion of the single case investigation, the completed Food/Water/Enteric Illness Questionnaire should be forwarded to the Regional Health Authority.

Investigations must include the assessment for specific risk groups. The type of work or school attendance may impact the individual's ability to attend work or school when they have an enteric illness. Specific risk groups include:

- Food Handlers
- Health Care or Child Care Staff
- Children below the age of five years
- Older children and adults with inability to attend to personal hygiene

Single case investigations may lead the investigator to suspect an enteric illness outbreak. When this occurs, the investigator shall immediately notify the Regional Health Authority by telephone and begin the outbreak investigation as per the procedures outlined in Part 2 below.

Part 2: Outbreak Investigation

Regional Outbreak

When an outbreak is limited to one region an investigation team, lead by the RMOH, should be assembled to carry out the investigation of an outbreak or suspected outbreak of enteric illness. A rapid and thorough response to an outbreak may control the magnitude of the outbreak and prevent future outbreaks from occurring. The investigation team should carry out the investigation in accordance with the internationally recognized procedures provided in the most recent editions of the documents:

1. *Procedures to Investigate Foodborne Illness*; and
2. *Procedures to Investigate Waterborne Illness*

Note: These documents are available from the International Association for Food Protection at <http://www.foodprotection.org/>.

An investigation team should consist of but not limited to the following members:

- RMOH
- Communicable Disease Control Nurse
- Environmental Health Program Manager
- Lead EHO Field Investigator
- GSC Manager

Please note that a Communication Consultant may be assigned to the team

To facilitate the collection of information during an outbreak or suspected outbreak, the ***Food/Water/Enteric Illness Questionnaire*** (Appendix A) may be used or an outbreak specific questionnaire may be developed by the investigation team. The questionnaire can be modified as new information is gathered during the course of the investigation. If the outbreak is of a national nature a questionnaire is often developed by Public Health Agency of Canada.

Following the completion of the outbreak investigation a written report should be prepared by the Lead EHO Field Investigator and submitted to the regional health authority. The RMOH sends a copy of the report to the Public Health Division. The written report will be a record of the events of the outbreak and may serve to enhance public health protection if the report's recommendations are followed. (Appendix A) The content of the report should include Summary, Introduction, Background, Methods, Results, Discussion, and Recommendations.

Provincial Outbreak

If an outbreak occurs in more than one region the Public Health Division of the Department of Health and Community Services will become involved in the coordination of the outbreak. Regions will require the outbreak team and this team, or a team lead; will work with the Province to ensure a consistent and coordinated approach.

Roles and Responsibilities

The role and responsibilities of the **Medical Officer of Health**:

- Ensure case/cases are investigated
- Ensure that appropriate public health measures have been activated
- If outbreak, assemble outbreak team

The role and responsibilities of the **Investigator**:

- Start the investigation upon receipt of a report of illness
- Complete food/waterborne/enteric illness questionnaires
- Conduct outbreak investigations in accordance with the procedures to investigate foodborne and waterborne illnesses
- Implement public health measures
- Report investigation to the RMOH

The role and responsibilities of the **Family Physician**:

- Patient Education, follow-up, and culture for special risk contacts
- Facilitate specimen collection
- Exclusions

The role and responsibilities of the **Laboratory**:

- Report positive tests in writing
- Telephone Reporting

Procedure for exclusion:

- Inform client
- Inform place of employment/child care centre

Foodborne Illness Outbreak Response Protocol (FIORP)

The Foodborne Illness Outbreak Response Protocol (FIORP) was established in 1999 to provide guidance to public health officials during foodborne illness outbreaks. The protocol was modified in 2010 in accordance with recommendations that were generated during the July 2009 *Listeriosis* outbreak.

FIORP guides collaboration in the identification and response to outbreaks affecting more than one province, territory or country. It describes general principles, defines responsibilities and focuses on information exchange and communication. Its main purpose is to provide a consistent, collaborative, and integrated approach to foodborne illness outbreak responses across health and agriculture portfolios in Canada. It also

serves as a model for which individual provinces and territories can develop their own outbreak response plans.

Newfoundland and Labrador participates in FIORP nationally and provides updates on outbreak situations to those in this province who are involved in the outbreak mitigation and response.

The following is a link to a document prepared by the Public Health Agency of Canada (PHAC) on FIORP: <http://www.phac-aspc.gc.ca/zoono/fiorp-pritioa/index-eng.php>

2.2 Botulism

Etiology

Toxins produced by *Clostridium botulinum*, a spore-forming obligate anaerobic bacillus, cause botulism. Only a few nanograms of the toxin can cause illness. Human botulism is primarily caused by the strains of *C. botulinum* that produce toxin types A, B and E. Strains of *C. baratii*, which produce type F toxin and *C. butyricum* which produce type E toxin, have also been implicated in human botulism.

Type G has been isolated from soil and autopsy specimens but an etiologic role has not been established. Most cases of infant botulism have been caused by type A or B. Botulinum toxin is considered the most potent lethal substance known to man.

Conditions that promote germination and growth of *C. botulinum* spores include absence of oxygen (anaerobic conditions), low acidity (pH > 4.6), temperatures > 4°C, and high moisture content.

Case Definition

Confirmed Case

A confirmed case requires laboratory definitive evidence with clinical evidence¹ or, in the case of foodborne botulism, clinical evidence and consumption of the same suspect food as an individual that has laboratory confirmed botulism

Foodborne Botulism

Laboratory confirmation of intoxication with clinical evidence¹:

- detection of botulinum toxin in serum, stool, gastric aspirate or food

OR

- isolation of *C. botulinum* from stool or gastric aspirate

AND

- clinical evidence and indication the client ate the same suspect food as an individual with laboratory confirmed botulism

Wound Botulism

Laboratory confirmation of infection:

- lab detection of botulinum toxin in serum

¹Foodborne: Clinical illness is characterized by blurred vision, dry mouth and difficulty swallowing and speaking. Descending and symmetric paralysis may progress rapidly, often requiring respiratory support.

Wound: Clinical illness is characterized by diplopia, blurred vision, and bulbar weakness. Symmetric paralysis may progress rapidly.

Infant: Clinical illness in infants is characterized by constipation, loss of appetite, weakness, altered cry and loss of head control

OR

- isolation of *C. botulinum* from a wound

AND

- presence of a freshly infected wound in the 2 weeks before symptoms and no evidence of consumption of food contaminated with *C. botulinum*

Infant Botulism

Laboratory confirmation with symptoms compatible with botulism in a person less than one year of age:

- detection of botulinum toxin in stool or serum

OR

- isolation of *C. botulinum* from the patient's stool, or at autopsy

Probable Case**Foodborne**

A probable case requires clinical evidence and consumption of a suspect food item in the incubation period (12-48 hours).

Clinical Presentation

The classic presentation is that of a person who develops acute, bilateral cranial neuropathies along with symmetrical descending weakness. The following are cardinal features present in botulism cases:

- Fever is absent (unless a complicating infection occurs).
- The neurologic manifestations are symmetrical.
- The patient remains responsive.
- The heart rate is normal or slow in the absence of hypotension.
- Sensory deficits do not occur (except for blurred vision).

There are four naturally occurring forms of botulism – foodborne (the classic form), wound, infant and adult intestinal toxemia botulism. In addition, two forms of botulism that have also been found and are not naturally occurring are:

Inhalation Botulism

This is a result of inhaling aerosolized botulism neurotoxin.

Iatrogenic Botulism

It is caused by accidental injection of the botulism neurotoxin into the systemic circulation instead of the intended therapeutic location.

Foodborne Botulism

It results from the ingestion of preformed toxin present in contaminated food. Symptoms usually develop between 12 and 36 hours after toxin ingestion. The initial complaints may be gastrointestinal and can include nausea, vomiting, abdominal cramps or diarrhea. Constipation is more likely to occur after the onset of neurologic symptoms.

Dry mouth, blurred vision, and diplopia are the earliest neurologic symptoms. Lower cranial nerve dysfunction manifests as; dysphasia (difficulty speaking), dysarthria (difficulty articulating), and hypoglossal (tongue) weakness. Symmetric weakness then descends to the upper extremities, the trunk, and the lower extremities. Respiratory dysfunction may require ventilation. Autonomic problems may also include; alterations in resting heart rate, loss of responsiveness to hypotension or postural change, hypothermia, and urinary retention. Recovery may not begin for up to 100 days and may take months to conclude. With critical care management, the death rate is about 14%.

Wound botulism

It lacks the prodromal gastrointestinal symptoms of the foodborne form, but is otherwise similar in presentation. Fever, if present, reflects wound infection rather than botulism. *C. botulinum* infection may also produce skin abscesses.

Botulism has also been reported in individuals with sinusitis as a result of cocaine inhalation. The reported incubation period varies from four to 14 days. The case fatality rate for wound botulism is approximately 15%.

Infant botulism

It is generally the most common form of botulism and affects infants under one year of age, with the majority of cases occurring between six weeks and six months old. Ingested spores germinate in the intestine, where they produce bacteria which then reproduce in the gut and release toxin. Clinical symptoms start with constipation and may include loss of appetite, weakness, altered cry, weak suck, drooling and a significant loss of head control. The illness has a wide spectrum of clinical severity, ranging from mild illness with gradual onset (that never requires hospitalization) to sudden infant death. Progression is more severe in infants that are younger than two months old.

Upper airway obstruction may be the initial sign, and is the major indication for intubation. In severe cases, the condition progresses to include cranial neuropathies and respiratory weakness, with respiratory failure occurring in about 50% of diagnosed cases. The condition progresses for one to two weeks, and then stabilizes for another two to three weeks before recovery starts. Relapses of infant botulism may occur.

Diagnosis

Botulism diagnosis is based primarily on clinical presentation and should be suspected in a person with acute onset of gastrointestinal, autonomic (such as dry mouth or difficulty focusing eyes), and cranial-nerve dysfunction (diplopia, dysarthria, dysphagia). The diagnosis is even more likely if the patient has recently eaten home-canned foods or if family members/companions who have shared the same meals are similarly ill. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Worldwide outbreaks occur primarily in areas which food products are not processed by methods to prevent toxin formation. In Canada botulism is a rare disease with an average of seven cases per year reported between 2001 and 2004. There has recently

been an upsurge of cases of wound botulism in injecting drug users, especially those that use skin or muscle “popping”; the drug is injected subcutaneously or intramuscularly.

Reservoir

Botulism is caused by a nerve toxin, botulin, produced by the bacterium *Clostridium(C) botulinum*. Botulin is the most lethal substance known with less than one microgram sufficient to cause fatal human disease. *C. botulinum*, commonly found in soil, form spores which allow them to survive in a dormant state until exposed to conditions that can support their growth.

Transmission

There are four mechanisms for botulism toxin to enter the body: foodborne, cutaneous, colonization of the gastrointestinal tract, and inhalational. Foodborne botulism results when food contaminated with spores of *C. botulinum* are ingested. Food contamination can occur if foods are preserved or stored under conditions that allow toxin production. Wound botulism results when *C botulinum* contaminates the wound and produces toxin. Infant botulism occurs when ingested spores colonize the intestinal tract with subsequent absorption of the toxin. Inhalational cases rarely occur naturally but it is the likely route in a large-scale bioterrorism event.

Incubation Period

In foodborne botulism the symptoms usually occur between 12-36 hours after ingestion of the contaminated food with the range from six (6) hours – ten (10) days. Wound botulism has a longer incubation period, usually four (4) – fourteen (14) days. In infant botulism the incubation period is estimated at three (3) to thirty (30) days.

Communicability

No incidence of person to person transmission has been documented.

Control Measures

Management of Cases

Investigations

- Contact the Microbiologist on call at the public health lab on 709-777-6583 for information on collection and transportation of both food and clinical specimens. Notification of a suspicion of a single case of botulism constitutes a public health emergency and may herald the beginning of a larger outbreak.
- Investigation of a suspect case of botulism includes a search for other possible cases, identification of suspect food exposures, and diagnostic testing of both cases and foods as needed.
- Efforts to locate persons exposed to the same suspect food may lead to early diagnosis and/or instituting an emergency product recall.

Foodborne Botulism

- Involve environmental/public health inspectors and CFIA.
- Collect food samples and forward to the laboratory for toxin analysis.
- Take a detailed food history of those who are ill, especially foods consumed within the last two or three days. Include consumption of home-preserved foods and traditionally prepared foods. Even theoretically unlikely foods should be considered. *C. botulinum* may or may not cause container lids to bulge and the contents to have “off-odours.” Other contaminants can also cause cans or bottle lids to bulge.
- Collect clinical samples (sera, gastric aspirates and stool) from patients and, when indicated, from others exposed but not ill and forward immediately, with relevant clinical history, to the Public Health Lab **before** administration of antitoxin.
- Identify individuals who may have been exposed to the same source.

Infant Botulism

- Investigate source, in particular, history of honey consumption.
- Identify individuals who may have been exposed to the same source.

Wound Botulism

- Contact the physician to determine the possible source of infection.
- Determine if history of trauma, or Intravenous Drug Use (IDU) and if possible forward sample of drug for testing.
- Identify individuals who may have been exposed to the same source.

Treatment

- Persons with botulism require immediate emergency medical treatment. Treatment must not await laboratory confirmation.
- Botulism antitoxin and immune globulin are not approved for sale in Canada. The antitoxin is available from the provincial vaccine depot through the Medical Officer of Health (MOH) or on call MOH (1-866-270-7437). Antitoxin requires completion of the Health Canada Special Access Program (SAP) form which is available at phone number: 613-941-2108 or fax 613-941-3194 or email address: http://www.hc-sc.gc.ca/dhp-mpps/acces/drugs-droques/index_e.html
- In children less than one year of age (< 1 year) human-derived botulism immune globulin (BabyBIG®) is indicated. BabyBIG® is not a licensed product in Canada. To obtain BabyBIG® the following steps are required:
- The physician must first contact the California Department of Health Services (DHS) Infant Botulism Treatment and Prevention Program on call physician at 510-231-7600 to review the indications for such treatment
- Product is obtained from the California DHS at 510-540-2646
- The use of an unlicensed product in Canada requires approval through Health Canada’s SAP (numbers listed above).
- Treatment focus for wound and foodborne botulism is early administration of the botulism antitoxin/immune globulin with immediate access to an intensive care

setting if ventilatory support is required. Giving antitoxin within 24 hours has been shown to decrease need for and duration of mechanical ventilation.

- Antibiotics do not improve the course of the disease. Aminoglycosides and tetracyclines (which can impair neuron calcium entry), have shown to worsen infant botulism. Thus, it is recommended that antibiotics only be used to treat secondary infections.

Wound Botulism

- Administration of antitoxin.
- The wound should be debrided and/or drainage established.
- Appropriate antibiotics (benzyl penicillin or metronidazole) should be administered.
- The best results are obtained when very large doses of antitoxin are given early in the disease process to provide the body with excess circulating antitoxin.
- Other treatment considerations include enemas, laxatives and other cathartics. If ingestion was recent, may induce vomiting and/or gastric lavage.

Management of Contacts

- Botulism is not passed person to person, therefore, direct contacts of the index case do not require follow-up.
- Those who are known to have consumed the suspected food should be purged with a cathartic, given gastric lavage and high enemas, and kept under close medical observation.
- Providing immunoprophylaxis for asymptomatic individuals strongly suspected of foodborne exposure is recommended. This decision should be weighed carefully due to the risk of adverse effects and sensitization to horse serum.
- If antitoxin is required, it should be given within one to two days of ingestion of the suspect food.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

- Wash hands prior to and after preparing food
- Keep all work surfaces, food, utensils, equipment clean during all stages of food preparation especially for canning processes
- Date and label preserves and canned goods and follow proper canning requirements strictly
- Refrigerate all foods labeled “keep refrigerated”

- Methods to control botulism should focus on the inhibition of bacterial growth and toxin production. Manufacturers of commercially canned low acid foods use strict thermal processes which are designed to destroy spores of *C. botulinum*.
- Search for any remaining food from the same source that may be similarly contaminated and submit for laboratory examination.
- The implicated food(s) should be detoxified by boiling before discarding or the containers broken and buried deeply in soil to prevent ingestion by animals.
- Contaminated utensils should be sterilized by boiling or by chlorine disinfection to deactivate any remaining toxins.
- Usual sanitary disposal of feces/diaper from infant cases.
- Educate the public about safe handling of food. For example:
 - Do not use food from damaged or bulging containers. These containers should be returned unopened to the vendor.
 - Foods with off-odours and unusual tastes should not be eaten or 'taste-tested'.
 - Proper storage is one of the keys to food safety. Refrigeration slows down most bacterial growth. Encourage people to check the temperature of their fridge on a regular basis with a refrigerator thermometer. Set the refrigerator at or below 4°C (40°F). Don't overload the fridge - cool air must circulate freely to keep food properly chilled. After grocery shopping, immediately refrigerate or freeze foods as indicated on the label.
 - Storing food in non-airtight containers and at 4°C or lower will prevent growth of the bacterium.
- Boil foods (for at least 10 minutes) and stir home-canned foods to destroy botulinum toxins.
- Take precautions with home-prepared foods stored in oil (e.g., vegetables, herbs and spices). If these products are prepared using fresh ingredients, they must be kept refrigerated (below 4°C) and for no more than 10 days.
- If the above products are purchased from fairs, farmer's markets, roadside stands or have received them as a gift, and prepared more than a week ago, discard them.
- Avoid feeding honey to infants (even pasteurized).
- Provide information to Aboriginal groups regarding food preparation traditions that pose a risk of botulism.
- Promote research to evaluate the safety of traditionally prepared (high-risk) foods, and to identify the precise conditions under which botulinum toxin will be present or absent. Areas to emphasize might include:
 - The importance of refrigeration with home-canning methods,
 - Heating food to temperatures high enough to kill the botulism toxin, and
 - Keep aging meats such as whale, seal or walrus in a cool place (below 4°C), in containers that allow air in and, if aged in oil, keep in a cool place and stir frequently to allow the meat to be in contact with air.
- Where wound botulism occurs in IDUs, educate them regarding safe injection practices.
- Do **NOT** inject into muscle or under the skin.

- Decrease the amount of citric acid used to dissolve the drug. Too much citric acid damages the tissues under the skin leaving them susceptible to bacterial growth.
- Studies have shown that when cocaine is mixed with heroin and when injected at the same site it gives bacteria a better chance to grow so, inject different drugs at different sites on the body.
- Teach IDUs signs and symptoms of infection(s) and to seek physician help especially if infection seems different than ones had in the past.
- Provide fact sheet available at <http://www.inspection.gc.ca/english/fssa/concen/cause/botulisme.shtml>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

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2.3 Campylobacteriosis

Etiology

Campylobacteriosis is an acute zoonotic bacterial infection of the gastrointestinal tract (enteric) or blood (extra-intestinal) caused by *Campylobacter* species. Enteric infections are most commonly associated with *Campylobacter jejuni* and extra-intestinal infections by *Campylobacter fetus*. Extra-intestinal infection occurs in fewer than 1% of cases. There are over 90 biotypes and serotypes.

Campylobacter is susceptible to many disinfectants and heat. The bacteria survive in moist environments (including droplets) especially at lower temperatures, but do not tolerate drying or freezing. These characteristics limit transmission. *Campylobacter* may survive in water for two to five days, in milk for three days, and in feces for up to nine days.

Case Definitions

Confirmed Case

Laboratory confirmation of infection with or without symptoms:

- isolation of *Campylobacter* sp. from an appropriate clinical specimen

Probable Case

Clinical illness in a person who is epidemiologically linked to a confirmed case.

Clinical Presentation

Infection with *Campylobacter* may present with variable severity of symptoms. Acute enteritis is the most common presentation including diarrhea ranging from massive watery to grossly bloody stools, malaise, fever, and abdominal pain. There may be a prodromal period with fever, headache, myalgia, and general malaise 12 to 24 hours before the intestinal symptoms appear.

Acute colitis, with symptoms of fever, abdominal cramps, and bloody diarrhea persisting for seven days or longer may present. On occasion, acute abdominal pain may be the only symptom of infection. *C. jejuni* may cause pseudo-appendicitis.

A transient fever may be the only symptom of infection that has occurred outside of the gastrointestinal tract. Additionally, systemic infection may include joint pain. It may cause bacteremia (in < 1% of cases), but this most often occurs in persons with underlying medical conditions such as diabetes or cancer.

Many *C. jejuni* infections are asymptomatic. Infection is most often self-limited and symptoms cease within two to five days. Illness may be prolonged in adults and relapses can occur. Guillain-Barré Syndrome (GBS) is an uncommon complication of *C. jejuni* infection occurring at a rate of approximately 1 case per 2000 infections. GBS usually

occurs two to three weeks after the diarrheal illness. Hepatitis, interstitial nephritis, and hemolytic uremic syndrome (HUS) are other reported complications.

Diagnosis

Diagnosis is made by culture of the organism from stool. Isolation of *C. jejuni* from food is difficult as the bacteria are usually present in low numbers. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Globally, 5-14% of reported cases of diarrhea are caused by infection with *Campylobacter*. In industrialized countries the illness affects predominantly children younger than 5 years of age and young adults. Virtually all cases occur as isolated, sporadic events, not as a part of large outbreaks. Most human illness is caused by one species, called *Campylobacter jejuni*. The mean incidence rate in Canada for 2000 – 2004 was 35.7 per 100,000. In Newfoundland Labrador the mean incidence rate for the same period was 12.2 per 100,000 population. In the year 2015, 56 cases were reported and in 2014, 40 cases were reported.

Reservoir

Many chicken flocks are silently infected with *Campylobacter*; that is, the chickens are infected with the organism but show no signs of illness. The organism can be easily spread from bird to bird through a common water source or through contact with infected feces. When an infected bird is slaughtered, *Campylobacter* can be transferred from the intestines to the meat. Unpasteurized milk can become contaminated if the cow has an infection with *Campylobacter* in her udder or the milk is contaminated with manure. Surface water and mountain streams can become contaminated from infected feces from cows or wild birds. Animals can also be infected, and some people have acquired their infection from contact with the infected stool of an ill dog or cat.

Transmission

Fecal-oral spread is the most common mode of transmission. This occurs by ingestion of contaminated food such as improperly cooked poultry or meat, or drinking unpasteurized milk and contaminated water. Person-to-person transmission is uncommon but has been reported among young children and in families.

Incubation Period

The incubation period is from two to five days with a range of one to ten days.

Communicability

Communicability is uncommon but is greatest during the acute phase of the disease.

Control Measures

Management of Cases

Investigations

- Obtain a food history.
- Identify recent ingestion of potentially contaminated food (especially poultry, beef, and pork) or water, or unpasteurized milk and the time of consumption.
- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission.
- Assessing for possible cross contamination (e.g. cutting boards).
- Determine occupational exposure (e.g., animal or meat handling).
- If necessary, determine history of high risk sexual practices, especially contact with feces.
- Identify history of recent travel especially to areas with inadequate sanitation, water and sewage treatment.
- Assess for history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- Identify recent illness in pets or acquisition of a puppy or kitten into the household.
- Assess for history of similar symptoms in other members of the household.
- Suspected contaminated food may be held to prevent of consumption.
- Suspected contaminated food may be destroyed.
- Contact precautions should be used for hospitalized children and for hospitalized adults who have poor hygiene or incontinence.

Treatment

- Rehydration and electrolyte replacement are considered the primary treatment and should be provided when indicated.
- Antimotility agents are not recommended.
- In most cases, infection is self-limited and treatment with antibiotics is not indicated. Treatment is recommended for persons who:
 - are immunodeficient,
 - have high fever,
 - are experiencing more than eight stools per day,
 - have symptoms that are not improving or are worsening after a week of illness,
 - have bloody diarrhea,
 - are pregnant.
- Antibiotics are prescribed according to the physician.

Exclusion

Exclusion (staying away from school or work) should be considered for symptomatic persons who are:

- Food handlers whose work involves
 - Touching unwrapped food to be consumed raw or without further cooking and/or

- Handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking.
- Healthcare, daycare or other staff who have contact through serving food with highly susceptible patients or persons, in whom an intestinal infection would have particularly serious consequences, Involved in patient care or care of young children, elderly or dependent persons.
- Children attending daycares or similar facilities who are diapered or unable to implement good standards of personal hygiene.
- Older children or adults who are unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- Advise work restrictions until the case has been symptom free for 48 hours.
- Asymptomatic individuals who are indicated in the above categories are generally not excluded from work or daycare, although the decision to exclude will be made by the MOH.
- Reassignment to a low risk area may be used as an alternative to exclusion.

Management of Contact

- Contacts should be instructed about disease transmission, appropriate personal hygiene, routine practices, and contact precautions.
- Symptomatic contacts should be assessed by a physician.
- Contacts who are symptomatic may be excluded from daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons as per MOH assessment.
- Asymptomatic contacts, in general, are not excluded from work or daycare.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

- Report cases to public health.
- Provide public education about personal hygiene, especially the sanitary disposal of feces and careful hand washing after defecation and sexual contact, and before preparing or eating food.
- Educate food handlers about proper food and equipment handling and hygiene, especially in avoiding cross-contamination from raw meat products, and thorough hand washing.
- Advise infected individuals to avoid food preparation.
- If necessary, educate about the risk of sexual practices that permit fecal-oral contact.
- If necessary, educate about condom use for safer sex.

- Test private water supplies for presence of bacterial contamination, if suspected.
- Thoroughly cook poultry and meats.
- Encourage careful hand washing after handling animals, including pets and livestock, or their feces.
- Provide fact sheet available at <http://www.health.gov.nl.ca/health/publichealth/envhealth/campylobacter.pdf>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

2.4 Cholera

Etiology

Two strains of cholera are associated with infection: *V. cholerae* serogroup O1 and *V. cholerae* serogroup O139. These are gram-negative, non-spore forming bacteria.

Vibrio cholerae serogroup O1 includes two biotypes: classical and El Tor. Each includes organisms of Inaba, Ogawa, and (rarely) Hikojima serotypes. The clinical pictures are alike because these organisms produce a similar enterotoxin. *V. mimicus* is a closely related species that can cause diarrhea. Some strains elaborate an enterotoxin indistinguishable from that produced by *V. cholerae* O1 and O139.

Case Definitions

Confirmed Case

Clinical evidence of illness with laboratory confirmation of infection through isolation of cholera toxin producing *Vibrio cholerae* serotype O1 or O139 from vomitus or stool.

Probable Case

Clinical evidence² of illness in a person who is epidemiologically linked to a confirmed case.

Clinical Presentation

Symptoms range from asymptomatic to severe illness. Asymptomatic cases occur more often than severe ones, especially with organisms of the El Tor type. The enterotoxin causes the acute intestinal illness. Mild or moderate diarrhea is present in roughly 90% of cases. In 5-10% of cases, infected individuals experience sudden onset of profuse painless watery stools, nausea, and vomiting. Stools are typically colorless with flecks of mucous ("rice water" diarrhea). The resulting loss of fluids in an infected individual can lead to rapid dehydration and hypovolemic shock which may be life threatening. Mortality ranges from greater than 50% for those without treatment to less than 1% among adequately treated individuals.

Diagnosis

Diagnosis is made by culturing *Vibrio cholerae* of the serogroup O1 or O139 from stool specimens. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Cholera infections are associated with poor sanitation and continue to be a major health problem in developing countries. Epidemics are strongly linked to the consumption of

² Cholera is characterized by acute watery diarrhea and/or vomiting. The severity of illness may vary.

unsafe water, poor hygiene, and crowded living conditions. The incidence of cholera is low in Canada where good sanitation, clean water and good hygiene exist.

Reservoir

The main reservoir is humans.

Transmission

The usual mode of infection is the ingestion of large numbers of organisms from contaminated water or food (particularly raw or undercooked shellfish, raw or partially dried fish, or moist grains or vegetables held at ambient temperature). Cholera outbreaks are usually caused by contaminated water, where sewage and drinking water supplies have not been adequately treated. Direct person to person spread has not been documented.

Incubation Period

The incubation period is usually from a few hours to five (5) days, usually two (2) - three (3) days.

Communicability

An infected individual remains infectious from the onset of illnesses until recovery.

CONTROL MEASURES**Management of Case*****Investigations***

- Obtain a food history.
- Determine recent consumption of other potential sources (e.g., eggs, dairy products, sprouts, etc.). Determine recent consumption of undercooked fish or shellfish.
- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission.
- Identify history of traveling to or residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- If necessary, identify history of high risk sexual practices, especially contact with feces.
- Determine history of exposure to pets or farm animals that may harbor the disease.
- Suspected contaminated food may be held or destroyed to prevent consumption.

Identify contacts, which may include:

- persons living in the household,
- children and childcare workers in a daycare and
- individuals exposed to the same source (if it is identified).

Treatment

- Mild disease does not require the use of antimicrobial therapy.
- Prompt fluid therapy with volumes of electrolyte solution adequate to correct dehydration, acidosis and hypokalemia is the keystone of treatment.
- Mild and moderate volume depletion should be corrected with oral solution (glucose-electrolyte solution).
- Since VO1 or VO139 can be resistant to antimicrobials and the treatment options are extensive, consultation with an infectious disease physician is suggested. When tetracycline resistant strains of *V. cholerae* are prevalent, alternative antimicrobial regimens include TMP-SMX, furazolidone, or erythromycin.
- Tetracycline and other antimicrobial agents (erythromycin, azithromycin, ciprofloxacin, doxycycline, chloramphenicol, furazolidone or cotrimoxazole) shorten the duration of the diarrhea and reduce the volume of rehydration solutions required, as well as shortening the duration of *vibrio* excretion.

Exclusion

Exclusion (staying away from school or work) should be considered for symptomatic and asymptomatic cases who are:

- Food handlers whose work involves
 - touching unwrapped food to be consumed raw or without further cooking **and/or**
 - handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking,
- Healthcare, daycare or other staff who have contact through serving food with highly susceptible patients or persons, who, in an intestinal infection would have particularly serious consequences.
- Involved in patient care or care of young children, elderly or dependent persons.
- Children attending daycares or similar facilities who are diapered or unable to implement good standards of personal hygiene.
- Older children or adults who are unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- Exclusion applies to symptomatic and asymptomatic cases until 48 hours after treatment with appropriate antibiotics, if required, has been completed and two stool specimens taken from the infected person not less than 24 hours apart and at least 48 hours after normal stools have resumed are reported as negative.
- Reassignment to a low risk area may be used as an alternative to exclusion.

Management of Contacts

- Symptomatic contacts should be assessed by a physician.
- All identified infections should be treated at the same time as the case.
- Contacts who are symptomatic may be excluded from daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons as per MOH assessment.
- Two stool specimens or cultures may be requested from symptomatic contacts not less than 24 hours apart. Specimens must be reported as negative prior to returning

- to daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons.
- Asymptomatic contacts, in general, are not excluded from work or daycare.
 - Persons who shared food and drink with a confirmed cholera case should be asked to report any diarrheal symptoms for five days from their last exposure.
 - An MOH may exclude healthcare and food handling contacts for the five days if deemed a transmission risk.
 - If there is a high probability of transmission based on food preparation history and usual hygiene, household members may be considered for chemoprophylaxis.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

- Educate the public about personal hygiene, especially the sanitary disposal of feces and careful hand washing after defecation and sexual contact, and before preparing or eating food.
- Educate food handlers about proper food handling and hygiene, especially in avoiding cross-contamination from raw meat products, and thorough hand washing.
- Advise infected individuals to avoid food preparation.
- Persons shedding *Salmonella* must be advised to maintain impeccable personal hygiene especially hand washing after defecation. This is particularly important if they handle food.
- If necessary, educate about the risk of sexual practices that permit fecal-oral contamination.
- If necessary, educate about condom use for safer sex.
- Encourage breastfeeding of infants.
- Advise travelers to contact a travel medicine clinic or physician six to eight weeks prior to departure for adequate counseling and/or vaccine administration.
- Advise travelers to countries where cholera is endemic to take appropriate precautions to avoid contact with, or ingestion of, potentially contaminated food or water. Most travelers visiting an area where cholera occurs are at very low risk of acquiring infection.
- Vaccination with the Chol-Ecol-O vaccine as a prevention strategy against travelers' diarrhea is of limited value and is not routinely recommended for the majority of travelers. Travelers who may be at significantly increased risk (e.g., high-risk expatriates such as relief and aid workers or health professionals working in endemic countries) may benefit from immunization.

- Travelers may wish to consider receiving the vaccine keeping in mind that vaccination is not recommended for the prevention of cholera in the majority of travelers to endemic areas as:
 - The risk of acquiring cholera for travelers is generally low.
 - Travelers should be advised to exercise general food and water precautions to minimize their risk of exposure. The key principals to remember are: boil it, cook it, peel it, leave it or be able to unseal it.
- Provide fact sheet available at:
 - <http://www.phac-aspc.gc.ca/tmp-pmv/info/cholera-eng.php#know>

For more information of cholera worldwide, visit the World Health Organization's Communicable Diseases Surveillance and Response page at:
<http://www.who.int/mediacentre/factsheets/fs107/en/>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health).

References

Clemens JD et al. Cross-protection by B. subunit-whole cell cholera vaccine against diarrhea associated with heat-labile toxin-producing *enterotoxigenic Escherichia coli*: Results of a large scale field trial. J Inf Dis 1988;158(2). Retrieved June 6, 2013 from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC174048/>

Weir E, Haider S. Cholera outbreaks continue. CMAJ 2004; 170(7). Retrieved June 6, 2013, from <http://www.cmaj.ca/content/170/7/1092.figures-only>

2.5 Cryptosporidiosis

Etiology

Cryptosporidium parvum is an intracellular protozoan parasite. A ubiquitous pathogen, it is one of both medical and veterinary importance. *Cryptosporidium parvum* is the most prevalent species causing disease in humans. Additional species names have been given when isolated from different hosts. It is known to infect and reproduce in the epithelial cell lining of the digestive or respiratory tracts of most vertebrates. *C. parvum* is a spore forming parasite. The lifecycle is completed within a single host.

Case Definition

Confirmed Case

Laboratory confirmation of infection with or without symptoms from an appropriate clinical specimen (e.g. stool, intestinal fluid or small bowel biopsy):

- demonstration of *Cryptosporidium* oocysts

OR

- detection of *Cryptosporidium* DNA

OR

- demonstration of *Cryptosporidium* antigen by an approved method (e.g. EIA, immunochromatographic – ICT)

Probable Case

Clinical illness³ in a person who is epidemiologically linked to a confirmed case.

Clinical Presentation

Asymptomatic infections with *C. parvum* are common and represent a source of infection for others. The major symptom is diarrhea, often profuse and watery, associated with abdominal cramping. Fever, malaise, anorexia, nausea, and vomiting occur but less often. The symptoms may come and go but, in general, abate within 30 days. In children, diarrhea may be preceded by anorexia and vomiting. Immunocompromised individuals (e.g., persons with AIDS) may not be able to clear the parasite. The disease can have a prolonged and fulminant course that may lead to death.

Diagnosis

Diagnosis is made through examination of stools, intestinal fluid or small bowel biopsy for oocysts or parasitic antigens. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

³ Clinical Illness is characterized by diarrhea (often profuse and watery), abdominal cramps, anorexia, fever, nausea, general malaise and vomiting

Epidemiology

Occurrence

The disease occurs worldwide and has become recognized as one of the most common causes of waterborne disease in humans in North America. Newfoundland Labrador has had an average of five cases per year from 2012-2015. In 2015, 8 cases were reported. The most common source of infection was related to travel. Extensive waterborne outbreaks have been associated with contamination of drinking water; exposure to contaminated recreational water including swimming pools, water slides, hot tubs, and lakes; and consumption of contaminated beverages.

Reservoir

The primary reservoir is cattle but other hosts include mammals, birds and reptiles. *Cryptosporidium* species are oocyst-forming protozoa. The most common species causing disease in humans are *Cryptosporidium hominis* and *Cryptosporidium parvum*.

Transmission

The mechanism of transmission is presumed to be contamination of the water supply by fecal material from cattle or other animals. Routes of transmission include animal to person, waterborne, foodborne and person-to-person.

Incubation Period

The incubation period is not known precisely; one to twelve days, with a mean of seven days.

Communicability

Oocysts, the infectious stage of the parasite, appear at the onset of the symptoms and are infectious immediately upon excretion. The oocysts may be excreted in stool for weeks beyond the symptoms of the disease however, in most cases the shedding of *C. parvum* stops within two weeks. These oocysts may remain infective outside the body for two to six months in a moist environment.

Control Measures

Management of Case

Investigations

Determine possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission. Assessment may include:

- Determine contact with cattle, sheep, or other domestic animals.
- Determine recent visits to farms or petting zoos.
- Determine consumption of contaminated food or water, or other drink including unpasteurized milk.
- Obtain a food history.
- Identify recent exposure to recreational water (treated or untreated).

- If necessary, determine history of high risk sexual practices, especially contact with feces.
- Identify history of recent travel.
- Assess for history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- Assess for history of daycare or institutional exposure.
- Assess for history of similar symptoms in other members of the household.
- Suspected contaminated food may be held to prevent consumption.
- Suspected contaminated food may be destroyed.
- Contact precautions are recommended when caring for the symptomatic patient.

Treatment

- General supportive therapy should always be considered, particularly in immunocompromised patients.
- Rehydration and electrolyte replacement if indicated.
- Drug therapy may be considered in some cases.
- There is no treatment of known value. For chronic cases, consultation with an infectious diseases physician who may consider experimental or unproven therapies is recommended.

Exclusion

Exclusion (staying away from school or work) should be considered for symptomatic persons who are:

- Food handlers whose work involves
 - Touching unwrapped food to be consumed raw or without further cooking and/or
 - Handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking.
- Healthcare, daycare or other staff who have contact through serving food, with highly susceptible patients or persons, in whom an intestinal infection would have particularly serious consequences.
- Involved in patient care or care of young children, elderly or dependent persons.
- Children attending daycares or similar facilities who are diapered or unable to implement good standards of personal hygiene.
- Older children or adults who are unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- Exclusion applies until at least 48 hours after normal stools have resumed.
- Asymptomatic individuals who are included in the above categories are generally not excluded from work or daycare. However, the decision to exclude will be made by the MOH.
- Reassignment to a low risk area may be used as an alternative to exclusion.
- When possible, people taking immunosuppressive therapy are advised to reduce or stop under the guidance of an infectious diseases physician.

Management of Contacts

- Contacts should be instructed in disease transmission, appropriate personal hygiene, routine practices, and contact precautions.
- Symptomatic contacts should be assessed by a physician.
- Contacts who are symptomatic may be excluded from daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons as per MOH assessment.
- Asymptomatic contacts, in general, are not excluded from work or daycare.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

- Prompt involvement of community health is essential.
- Education of case/s and contacts on the importance of hygienic measures including
 - Hand hygiene – Wash hands thoroughly with soap and water (Note: *Cryptosporidium* are not killed by alcohol gels and hand sanitizers) before and after eating and after using the toilet
 - Safe disposal of feces – feces is highly infectious. Cases must avoid swimming in recreational water for at least two weeks after the diarrhea stops.
- If necessary, educate about the risk of sexual practices that permit fecal-oral contact.
- Avoid water that might be contaminated.
- Do not drink untreated water from shallow wells, lakes, rivers, and streams.
- Boil water for one minute to make it safe.
- Avoid food that might be contaminated.
- Use safe, uncontaminated water to wash all food that is to be eaten raw.
- Strict attention to the cleaning and disinfection of swimming pools.
- Travelers need to be advised about the risks involved in traveling to areas where sanitation may be questionable.
- Avoid eating uncooked foods when traveling in countries with minimal water treatment systems
- Provide fact sheet available at:
http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/giardia_cryptosporidium-eng.php

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries.

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

US Food and Drug Administration Centre for Food Safety and Applied Nutrition.
Foodborne Pathogenic Microorganisms and Natural Toxins. Bad Bug Book. 1992.
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<http://www.fda.gov/Food/FoodbornellnessContaminants/CausesOfIllnessBadBugBook/ucm070753.htm>

2.6 Cyclosporiasis

Etiology

Cyclosporiasis is an enteric illness caused by *Cyclospora cayetanensis*, a sporulating coccidian parasite. Cyclospora are resistant to chlorination.

Case Definition

Confirmed Case

Laboratory confirmation of infection in a person with or without clinical illness:

- Demonstration of *Cyclospora cayetanensis* oocysts in stool, duodenal/jejunal aspirate or small bowel biopsy.

Probable Case

Clinical illness⁴ in a person with evidence of:

- an epidemiologic link to a confirmed case either by consumption of the same food or exposure to food known to be handled by a confirmed case

OR

- a history of travel to a cyclospora-endemic area.

Clinical Presentation

Cyclospora infects the small intestine. The onset of the illness is abrupt. Watery diarrhea (six or more stools per day) is most commonly the initial symptom of infection. However, in some cases, a flu-like illness may precede the diarrhea. Loss of appetite, abdominal bloating and cramping, increased flatus, nausea, fatigue, and low-grade fever also characterize clinical illness.

The infection is typically self-limited, lasting two to seven weeks. Illness may be cyclic or relapsing. Weight loss is common. In immunocompromised individuals the diarrhea may be severe and persist for months. The duration of illness in endemic areas (tropical and sub-tropical areas e.g., Peru, Nepal) is short-lived and many people are asymptomatic carriers. Asymptomatic infection is rare in Canada.

Diagnosis

Diagnosis is made by the identification of oocysts in the stool, duodenal/jejunal aspirate, or small bowel biopsy specimen. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

⁴ Clinical illness is characterized by watery diarrhea, loss of appetite, weight loss, abdominal bloating and cramping, increased flatus, nausea, fatigue and low-grade fever. Vomiting may also be noted. Relapses and asymptomatic infections can occur. Some evidence suggests that symptoms may be more severe and long-lasting in immunocompromised individuals.

Epidemiology

Occurrence

Cyclospora is endemic in many developing countries and has been reported as a cause of traveler's diarrhea. Outbreaks in the United States and Canada during 1996-1998 were associated with ingestion of fresh raspberries imported from Central America.

Reservoir

Cyclospora organisms are intestinal pathogens of humans that are increasingly recognized in many parts of the world; yet, the reservoirs and host range remain poorly defined.

Transmission

Indirect transmission can occur if an infected person contaminates the environment and oocysts have sufficient time, under appropriate conditions, to become infectious. For example, *Cyclospora* may be transmitted by ingestion of water or food contaminated with oocysts. Transmission of *Cyclospora* directly from an infected person to someone else is unlikely.

Incubation Period

The incubation period is approximately seven (7) days (range, one to fourteen days).

Communicability

The disappearance of symptoms and oocysts usually occurs simultaneously. The mean duration of organism shedding is 23 days.

Control Measures

Management of Case

Investigations

- Obtain a food history.
- Determine consumption of contaminated food or water, or other drink including unpasteurized milk.
- Determine contact with a potential source (reservoir) especially recent consumption of fresh produce, e.g., raspberries, basil or lettuce.
- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission.
- Identify history of recent travel.
- Identify history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- Assess for history of similar symptoms in other members of the household.
- Suspected contaminated food may be held to prevent consumption.
- Suspected contaminated food may be destroyed.

Treatment

- In most cases, cyclosporiasis is a self-limited disease and treatment is not indicated.
- Anti-motility agents are not recommended.

Antibiotics

- When symptoms persist, trimethoprim-sulfamethoxazole (TMP-SMX) may be prescribed:
 - seven days for children and adults.
 - ten days followed by chronic prophylaxis three times per week for individuals with HIV. Relapse is common.

Exclusion (*staying away from school or work*)

- Symptomatic and asymptomatic individuals are generally not excluded from work or daycare.
- Routine practices should be used in healthcare settings.

Management of Contacts

- Person to person transmission has not been documented.
- Individuals exposed to the suspected source of the infection should be instructed about disease transmission and appropriate personal hygiene.
- Individuals exposed to the suspected source of the infection may be monitored during the incubation period and offered treatment as necessary.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures associated with cases. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

- On the basis of currently available information, avoiding food or water that might be contaminated with stool is the best way to prevent infection.
- Produce should be washed thoroughly before it is eaten, although this practice does not eliminate the risk of cyclosporiasis.
- Cooking and baking fruits and vegetables will eliminate the risk of infection.
- Risk can be reduced through rigorously enforced controls on production, harvesting and packaging of foods.
- Provide fact sheet
<http://healthycanadians.gc.ca/eating-nutrition/risks-recalls-rappels-risques/poisoning-intoxication/poisoning-intoxication/cyclospora-eng.php>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

American Public Health Association. *Control of communicable diseases manual* (19th ed). Heymann DL (ed.). Washington, DC: 160-161. 2008.

2.7 Giardiasis

Etiology

Giardia lamblia (also known as *Giardia intestinalis*) is a flagellate protozoan that infects the biliary tract and upper small intestine. It exists in trophozoite (free living stage) and cyst forms. The cyst is the infective form and is sporadically excreted in feces. *Giardia* cysts survive well in the environment, particularly in cold water. If cysts are found in drinking water, boiling the water for a minimum of one minute may inactivate them.

Case Definition

Confirmed Case

Laboratory confirmation of infection with or without symptoms from stool, duodenal fluid, or small bowel biopsy specimen:

- demonstration of *Giardia lamblia*
- OR**
- demonstration of *Giardia lamblia* antigen

Probable Case

Clinical illness⁵ in a person who is epidemiologically linked to a confirmed case

Clinical Presentation

Giardiasis is often asymptomatic. Symptomatic individuals may suffer a broad spectrum of manifestations including the acute onset of intermittent acute watery diarrhea, steatorrhea, abdominal cramps and distention, flatulence, and anorexia. Periods of diarrhea may alternate with constipation until the individual has been treated or the symptoms resolve spontaneously. Vomiting, fever, and tenesmus occur less commonly. One of the most distinguishing features of illness is the prolonged duration of diarrhea. As the disease progresses the stool becomes greasy, foul-smelling, and may float. The malabsorption of fats and fat soluble vitamins can occur with prolonged illness. Weight loss is common.

The infection is often self-limited lasting a few weeks to months. Most persons with giardiasis have a relatively benign course of infection; however some individuals, in particular children younger than five years of age and pregnant women, may have severe illness characterized by weight loss and require hospitalization.

⁵ Clinical illness is characterized by diarrhea, abdominal cramps, bloating, weight loss, fatigue or malabsorption.

Diagnosis

Giardiasis should be considered in persons with prolonged diarrhea especially when associated with malabsorption or weight loss. The diagnosis is most often made by examination of stool for ova and parasites. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Giardiasis, sometimes called 'beaver fever', is the most common cause of endemic and epidemic diarrhea throughout the world. The causative organism is *Giardia intestinalis* (also known as *Giardia lamblia*). People who spend time in institutional or day-care environments are more susceptible, as are travelers and those who consume improperly treated water. The mean annual incidence reported in Canada from 2000 to 2004 was 14.6 per 100,000 population and for the same period the mean incidence rate in Newfoundland Labrador was 7.8 per 100,000. Twenty three cases of *Giardia* were reported in year 2015 in NL.

Reservoir

Humans are the principal reservoir but *Giardia* organisms can infect beavers, dogs, cats, and other animals. These animals can contaminate water with feces containing cysts that are infectious for humans. People should be educated regarding drinking for untreated water such as roadside streams.

Transmission

Giardiasis is passed via the fecal-oral route. People become infected directly by ingestion of cysts from the feces of an infected person or indirectly by ingestion of water or food contaminated with feces. Person-to-person transmission is common where personal hygiene may be poor. Children who are not toilet trained are often linked to day care and family outbreaks.

Incubation Period

The incubation period is usually three to twenty five days; median 7-10 days.

Communicability

The period of communicability extends through the course of the infection (as long as the person excretes the cysts).

Control Measures

Management of Case

Investigations

- Complete the appropriate food/waterborne illness questionnaire.
- Determine history of travel, wilderness hiking or camping and the use of untreated drinking water.

- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission. Assessment may include:
 - Determine history of high risk sexual practices especially contact with feces, and
 - Identifying attendance at daycare or other type of institutional contact (e.g., continuing care facility).
- Investigate for possible contamination of well or water supply.
- Identify history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- Assess for similar symptoms in other members of the household (historical or present).

Treatment

- Symptomatic cases should be treated.
- Antibiotics are prescribed according to the physician.
- Treatment of asymptomatic carriers is generally not recommended.

Exclusion

Exclusion (staying away from school or work) should be considered for symptomatic and asymptomatic persons who are

- Food handlers whose work involves
 - touching unwrapped food to be consumed raw or without further cooking and/or
 - handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking,
- Healthcare, daycare or other staff who have contact through serving food with highly susceptible patients or persons, in whom an intestinal infection would have particularly serious consequences, involved in patient care or care of young children, elderly or dependent persons.
- Children attending child care or similar facilities who are diapered or unable to implement good standards of personal hygiene.
- Older children or adults who are unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- Exclude symptomatic individuals from work or child care environments until asymptomatic for 48 hours.
- Reassignment to a low risk area may be used as an alternative to exclusion.

Management of Contacts

- Contacts should be instructed in disease transmission, appropriate personal hygiene, routine practices, and contact precautions.
- Symptomatic contacts should be assessed by a physician.
- All identified infections should be treated at the same time as the case.
- Contacts who are symptomatic may be excluded from daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons as per MOH assessment.

- Two stool specimens or cultures may be requested from symptomatic contacts not less than 24 hours apart. Specimens must be reported as negative prior to returning to occupations involving food handling, child care, patient care or care of young, elderly or dependent persons.
- Asymptomatic contacts, in general, are not excluded from work or child care.

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

- Provide public education about personal hygiene, especially the sanitary disposal of feces and careful hand washing after defecation and sexual contact, and before preparing or eating food.
- Educate food handlers about proper food and equipment handling and hygiene, especially in avoiding cross-contamination from raw meat products, and thorough hand washing.
- Advise infected individuals to avoid food preparation.
- Educate about the risk of sexual practices that permit fecal-oral contact.
- Educate about condom use for safer sex.
- Test private water supplies for presence of contamination, if suspected.
- Advise individuals to avoid using public swimming pools when feces cannot be contained or when experiencing diarrhea. Water contained in public swimming areas can be a vehicle for the human to human transmission of enteric pathogens.
- Educate regarding good personal hygiene, especially hand washing for staff and children in institutions and daycares.
- Educate campers, backpackers, and others to avoid drinking water directly from streams. Water should be boiled for at least one minute before it is used for drinking, food preparation, and oral hygiene.
- Prevent water outbreaks by the combination of adequate filtration of water from surface water sources (e.g., lakes, rivers, streams), chlorination, and maintenance of water distribution systems.
- Provide a fact sheet available at:
http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/giardia_cryptosporidium-eng.php

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)

- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

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2.8 Hepatitis A

Etiology

Hepatitis A virus (HAV) is a 27-nm picornavirus (i.e., a positive-strand RNA virus). It has been classified a *Hepatovirus*, a member of the family *Picornaviridae*.

Case Definition

Confirmed Case

Laboratory confirmation of infection in the absence of recent vaccination:

- detection of immunoglobulin M (IgM) antibody to hepatitis A virus (anti-HAV)

AND

- acute clinical illness (see section 5.0)

OR

- an epidemiological link to a person with laboratory-confirmed hepatitis A infection.

Probable Case

Acute clinical illness⁶ in a person without laboratory confirmation of infection who is epidemiologically linked to a confirmed case.

Clinical Presentation

Hepatitis A is one of the oldest diseases known to mankind. In persons infected with HAV, the virus replicates in the liver, is excreted in bile and shed in stool. The infection is typically an acute, self-limited illness.

Acute clinical illness typically has an abrupt onset of fever, malaise, anorexia, nausea and vomiting, abdominal discomfort, dark urine and pale stools (referred to as prodromal phase), followed by an icteric phase, during which jaundice develops. The icteric phase generally begins within 10 days of the onset of the initial symptoms. The disease varies in clinical severity from a mild illness lasting 1–2 weeks, to a severely disabling disease lasting several months, although this is rare. Prolonged or relapsing disease lasting up to twelve months can occur in approximately 15% of cases. Fulminant hepatitis is rare but can occur more frequently in individuals with underlying liver disease. The likelihood of developing symptomatic illness from HAV infection is directly related to age, with only 30% of infected children younger than 6 years of age showing symptoms; if illness does occur, few of these children will have jaundice. Older children and adults are more likely to have symptomatic illness with jaundice occurring in more than 70% of cases. Generally, severity increases with age, but complete recovery without sequelae or recurrences is the rule. Chronic infection does not occur. The reported case fatality rate among reported cases of all ages is approximately 0.3%, but can be higher among older persons (approximately 2% among persons 40 years of age or greater).

⁶ Acute clinical illness is characterized by discrete onset of symptoms including fever, malaise, anorexia, nausea and abdominal pain followed by jaundice or elevated aminotransferase levels within a few days.

Diagnosis

Hepatitis A is not clinically distinguishable from other forms of viral hepatitis; therefore the diagnosis is established by the demonstration of IgM antibody to HAV (anti-HAV IgM) in the serum of acutely or recently ill persons. Anti-HAV IgM usually becomes detectable 5–10 days before the onset of symptoms and may remain detectable for up to 6 months. IgG appears in the convalescent phase of infection and persists for life, conferring lifelong immunity. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Hepatitis A occurs sporadically worldwide and is endemic throughout the developing world. People born and raised in developing countries, and people born in developed countries before 1945 have usually been infected in childhood with an asymptomatic or mild case of hepatitis A and are likely to be immune to the disease. Individuals from developed countries born after 1945 are at risk for acquiring hepatitis A, especially when traveling to endemic areas. In Canada there were less than 400 cases per year between 2000 and 2004. Newfoundland Labrador reported one to four cases per year during this period. In 2015 around two cases were reported in NL; Cases in NL are related to travel.

Reservoir

The reservoir is typically humans.

Transmission

The most common mode of transmission is person-to-person, resulting from fecal contamination and oral ingestion (i.e., the fecal-oral route). Infection may occur by consumption of contaminated ice/water or by ingestion of uncooked or undercooked foods that have been washed in contaminated water. Raw shellfish are a particular common source of infection.

Incubation Period

The incubation period is from 15 to 50 days (average 28-30 days).

Communicability

The period of communicability is between one to two weeks before and for at least one week after the onset of illness. Most cases are probably noninfectious after the first week of jaundice. HAV can be detected in stool for longer periods, especially in neonates and younger children.

Control Measures

Management of Case

Investigations

Confirm the diagnosis.

- Obtain a history of illness including date of onset, signs and symptoms, onset date of jaundice. For the purpose of public health follow-up, date of onset is the first day

of prodrome **OR** the 7th day prior to the onset of jaundice, if prodrome is not known. Prodrome refers to the early symptoms suggestive of the onset of disease and, in this case, may include abrupt onset of fever, malaise, anorexia, nausea and vomiting, abdominal discomfort, dark urine and pale stools.

- Determine the dates of communicability (period of infectiousness).
- Determine occupation of the case (e.g., food handler, childcare facility worker, healthcare worker, etc) and identify specific duties at work. When assessing food handlers, determine if their work involves activities such as:
 - Touching unwrapped food to be consumed raw or without further cooking and/or
 - Handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking.
- If the case is a child, determine attendance at a childcare facility (e.g., daycare) or other childcare arrangements or school attended and grade.
- Determine the possible source of infection taking into account the incubation period, reservoir and mode of transmission. Assessment should include:
 - Determining history of travel.
 - Obtaining a detailed food history especially consumption of contaminated ice/water, uncooked or undercooked food or food washed in contaminated water.
 - Determining history of living in areas with poor sanitation including improper water treatment and sewage disposal, and include recent immigration.
 - Identifying any risk behavior's including lifestyle risks for infection (e.g., MSM, IDU).
 - Determining if the case attends a childcare facility or other type of institutional setting (e.g. living in a correctional facility or residential/institutional setting).
 - Determining if there was any contact with a confirmed case of hepatitis A or contact with an ill person who had symptoms that were clinically compatible with hepatitis A infection.
 - Assessing for similar symptoms in other members of the household (historical and present) and
 - Inquiring about receipt of blood or blood product transfusion, or organ transplantation.
 - Identify contacts who may have had exposure during the period that the case was infectious (period of communicability):

Consider the following when identifying contacts:

- Close personal contacts (e.g., household contacts, sexual contacts including MSM, regular babysitter/childcare provider, contacts in long-term care facilities).
- Persons who have spent 24 hours or more in the household.
- Persons who have eaten food prepared or handled by the case during the infectious period.
- Persons who have had or may have had indirect contact through sharing potentially contaminated items with the case (i.e., items that could be contaminated with feces due to handling by the case).
- Childcare facility contacts including staff.

- Persons who have shared illicit drugs with the case and
- Others who may have had contact with the feces of the case (e.g., in the case of diapered children or others who are incontinent) where good standards of hygiene have not been met.

Treatment

No specific therapy; treatment is supportive.

Exclusion

Exclusion (staying away from school or work) of cases involved in sensitive occupations or situations (i.e., those who pose a higher risk of transmission to others) for fourteen (14) days from the onset of their illness or for at least seven (7) days after the onset of jaundice. These would generally include:

- Food handlers whose work involves:
 - Touching unwrapped food to be consumed raw or without further cooking and/or
 - Handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking. NOTE: Generally, foodhandlers who do not touch food, equipment or utensils in this way are not considered to pose a transmission risk however, circumstances for each case should be assessed on an individual basis.
- Healthcare workers providing direct patient care and persons involved in the care of young children, elderly, highly susceptible or dependent persons.
- Children attending a childcare facility or similar facilities who are diapered or unable to implement good standards of personal hygiene.
- Any individual (child or adult) who is unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- Advise all other cases (i.e., those not involved in sensitive occupations or situations) to remain at home while they are acutely ill.

Management of Contacts

- Provide information about Hepatitis A virus and appropriate infection prevention and control measures. Stress the measures to be taken to minimize possible fecal-oral transmission including thorough hand washing, especially after using the washroom, changing diapers, and before eating and preparing/handling foods.
- Assess all contacts, including visitors to the household for potential of exposure during period of communicability for the case.
- Identify contacts that would be considered to have immunity against hepatitis A. A person would be considered immune if they had:
 - History of confirmed hepatitis A disease.
 - Completed an appropriately spaced series of hepatitis A containing vaccine(e.g., Havrix, Vaqta, Twinrix).
 - Received one dose of hepatitis A containing vaccine between one and six months prior to exposure.
 - Received immune globulin (Ig) within the last 3–5 months (dependent on the dose) prior to exposure to the hepatitis A case.

- Exclude symptomatic contacts who are involved in sensitive occupations or situations until they have been assessed to rule out hepatitis A disease.
- Sensitive occupations or situations would include persons who are food handlers whose work involves:
 - Touching unwrapped food to be consumed raw or without further cooking and/or
 - Handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking. NOTE: Generally, food handlers who do not touch food, equipment or utensils in this way are not considered to pose a transmission risk however, circumstances for each case should be assessed on an individual basis.
- Healthcare workers providing direct patient care and persons involved in the care of young children, elderly, highly susceptible or dependent persons.
- Children attending a childcare facility or similar facilities who are diapered or unable to implement good standards of personal hygiene.
- Any individual (child or adult) who is unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- Exclusion of asymptomatic contacts, with no known immunity to hepatitis A, may be considered in special circumstances such as food handlers who have had ongoing exposure to the case during the period of communicability and have not received post-exposure prophylaxis within 14 days of initial contact with the case. It is recommended to test for
 - Anti-HAV IgM and anti-HAV IgG (immunity) and exclude from work pending serology results.
 - If HAV IgM and IgG are both reported negative provide post-exposure prophylaxis (as outlined below) and lift exclusion.
 - If HAV IgM is negative and IgG is positive, lift exclusion.
 - If HAV IgM is positive, treat as a case.
- Advise all asymptomatic contacts to monitor for symptoms and connect with their physician for assessment and notify public health if they develop symptoms of hepatitis A.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

Strategies to prevent transmission of hepatitis A include:

- Pre-exposure prophylaxis – Provincially funded hepatitis A vaccine is available for specific persons at increased risk of infection or increased risk of severe hepatitis A including:

- People who have chronic liver disease or who are receiving hepatotoxic medication, including persons infected with hepatitis B & C.
- People with hemophilia A or B receiving plasma-derived replacement clotting factor.
- Residents of communities that have high endemic rates of HAV or are at risk of HAV outbreaks.
- Education of the public about good sanitation and personal hygiene, with special emphasis on careful handwashing.
- Child care centers should be vigilant with hand hygiene procedures and diapering practices.
 - Food establishments should ensure compliance with the Food Premises Regulations available at <http://assembly.nl.ca/Legislation/sr/regulations/rc961022.htm> .
- Ensure provision of proper water treatment, water distribution systems and sewage disposal.

Advice to travelers

- Hepatitis A vaccine is recommended and may be purchased by travelers to countries where hepatitis A is endemic.
- Visit a travel clinic prior to travel.
- Provide information available at <http://www.phac-aspc.gc.ca/publicat/cig-gci/p04-hepa-eng.php>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries.

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

Advisory Committee on Immunization Practices (ACIP), Fiore AE, Wasley A, Bell BP. Prevention of hepatitis A through active or passive immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep 2006 May 19;55 (RR-7):1-23. Retrieved June 6, 2013, from <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5507a1.htm>

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2.9 Listeriosis

Etiology

Listeria monocytogenes are small gram-positive, non-spore forming, aerobic bacilli. Human infections are usually caused by serogroups 1/2a, 1/2b, and 4b. The bacteria survive well in soil, water, food, and feces. They are able to grow at low temperatures (3° C to 45° C) and are resistant to freezing and drying.

Case Definition

Confirmed Case

Laboratory confirmation of infection with symptoms:

- isolation of *Listeria monocytogenes* from a normally sterile site (e.g. blood, cerebral spinal fluid (CSF), or joint, pleural or pericardial fluid).

OR

- in the setting of miscarriage or stillbirth, isolation of *L. monocytogenes* from placental or fetal tissue (including amniotic fluid and meconium).

Probable Case

Clinical illness⁷ in a person who is epidemiologically linked to a laboratory-confirmed case or to a confirmed source.

Clinical Presentation

Listeriosis is a bacterial infection. The clinical manifestations of infection range from mild (gastroenteritis) to severe. Typical symptoms include fever, muscle aches, and on occasion, nausea and vomiting. The bacteria may infect the brain and the membrane lining the brain causing meningoen­cephalitis. The onset of meningoen­cephalitis may be sudden with fever, intense headache, nausea, and vomiting. Complications include endocarditis, and internal and external abscesses. Direct contact with infectious material or soil contaminated with infected animal feces can result in papular lesions on hands and arms. Asymptomatic fecal carriage occurs in approximately 10% of cases.

Infected pregnant women may have minimal symptoms typically characterized by a mild flu-like illness. She may unknowingly pass the illness to her unborn child. Infection during pregnancy may lead to premature delivery, infection of the newborn or stillbirth. The infant may develop meningitis. Thirty per cent of newborn infections are fatal. The case-fatality rate is 50% if the onset of illness occurs within the first four days of life.

Diagnosis

The diagnosis is confirmed by isolation of the bacteria from CSF, blood, amniotic fluid, placenta, meconium, lochia, gastric washings, and other sites of infection. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

⁷ Invasive clinical illness is characterized by meningitis or bacteremia. Infection during pregnancy may result in fetal loss through miscarriage, stillbirth, neonatal meningitis or bacteremia.

Epidemiology

Occurrence

Listeriosis occurs worldwide. Illness is rare and most infections are asymptomatic. Typically infection occurs sporadically; however, outbreaks can occur in all seasons. In Canada, listeriosis has been reportable since 1990. On average, in Newfoundland and Labrador there are one to 2 cases of listeriosis per year and generally it occurs in those over the age of 65. Although healthy people can be infected, the disease generally affects:

- Pregnant women – they are about 20 times more likely than other health adults to get listeriosis. About one-third of cases happen during pregnancy.
- Newborns – Newborns rather than the pregnant women themselves suffer the serious effects of infection in pregnancy.
- Immunocompromised persons, for example those with HIV/AIDS, cancer, chronic renal disease or chronic liver disease, diabetes, and those on immunosuppressive medication
- The elderly – the risk increases with age.

Reservoir

Listeria monocytogenes is very common in the environment. The primary reservoirs of *Listeria monocytogenes* are soil and decomposing organic matter and may also be found in dust, water and foods. Animal reservoirs include infected domestic and wild mammals, birds, and man. Asymptomatic fecal carriage is common in humans (up to 10%) and animals.

Seasonal use of silage as feed is frequently followed by increased incidence of listeriosis in animals.

Transmission

Cases of listeriosis have been reported in association with ingestion of raw or contaminated milk, soft cheeses, vegetables, and ready-to-eat meats, such as cold cuts and pate. Person to person transmission is rare other than in neonates when transmission may occur from mother to fetus in utero or during the passage through the infected birth canal. A substantial proportion of sporadic cases result from foodborne transmission. Vegetables and fruit may become contaminated from the soil or from manure used as fertilizer.

Incubation Period

The incubation period is not known with certainty but probably ranges from three to seventy days with an estimated median incubation period of three weeks.

Communicability

Mothers of infected newborns can shed the agent in vaginal discharges and urine during and up to seven to ten days after delivery. Infected individuals can shed the organism in their stool for several months.

Control Measures**Management of Case*****Investigations***

Determine the possible source of the infection taking into consideration the incubation period, reservoir, and mode of transmission. Assessment may include:

- Obtain a detailed food history focusing on foods potentially contaminated with *L. monocytogenes* such as unpasteurized cheese, milk, yogurt, deli meats, raw or undercooked wieners, fresh unwashed garden vegetables, and paté.
- Collecting food samples for culture if available.
- Determine a history of contact with infective materials such as aborted animal fetuses on farms, sick or dead animals (especially sheep with encephalitis), animal feeds, animal compost, and manure.
- Determine history of daycare or hospital exposure.
- Identify potentially contaminated water source.
- Identify others who may have been exposed to the same source.
- Suspected contaminated food may be held to prevent consumption.
- Suspected contaminated food may be destroyed.

Treatment

- Immediate treatment is essential.
- Routine practices for hospitalized individuals.
- Prophylactic antibiotics should be administered to asymptomatic newborns if they have short gram-positive rods in meconium.
- Supportive treatment.

Management of Contacts

- No public health intervention is required as person to person transmission rarely occurs.
- Symptomatic and asymptomatic contacts should be investigated if a common source is suspected.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

General recommendations:

- Thoroughly cook raw food from animal sources (e.g., beef, pork, and poultry).
- Wash raw vegetables and fruit before eating.
- Keep uncooked meats separate from vegetables, cooked foods, and ready-to-eat foods.
- Avoid consumption of unpasteurized milk or foods made from raw milk.
- Wash hands, knives, and cutting boards after handling uncooked foods.
- Additional recommendations for persons at high risk (previously defined) include:
 - avoid unpasteurized cheeses (this does not apply to pasteurized cheeses, cream cheese, cottage cheese or yogurt).
 - do not eat refrigerated pates or meat spreads.
 - do not eat refrigerated smoked seafood, unless it is contained in a cooked dish such as a casserole.
 - reheat leftovers of ready-to-eat foods should be steaming hot before eating.
 - do not eat luncheon meats or deli meats unless they are reheated until steaming hot.
- Educate veterinarians and farmers to take proper precautions in handling aborted fetuses, and sick or dead animals.
- Avoid the use of untreated manure on vegetable crops.
- Investigate clusters for a possible common source.
- Take care to note food recalls by Canadian Food Inspection Agency (CFIA).
- Provide a fact sheet available at http://www.health.gov.nl.ca/health/publichealth/envhealth/listeriosis_aug2008.pdf

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries.

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website

Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

Guide to Services. Provincial Laboratory for Public Health (Microbiology) and Capital Health Medical Microbiology

2.10 Nontuberculous Mycobacterial Disease

Etiology

Mycobacteria are a family of small, rod-shaped bacilli that can be classified into 3 main groups for the purpose of diagnosis and treatment:

- *Mycobacterium tuberculosis* complex which can cause tuberculosis: *M. tuberculosis*, *M. bovis*, *M. africanum*, *M. microti* and *M. canetti*.
- *M. leprae* which causes Hansen's disease or leprosy.
- Nontuberculous mycobacteria (NTM) are all the other mycobacteria which can cause pulmonary disease resembling tuberculosis, lymphadenitis, skin disease, or disseminated disease.

Case Definition

Confirmed Case

- Cases with mycobacterium other than *Mycobacterium tuberculosis* complex demonstrated on culture such as *Mycobacterium avium intracellulare* complex (MAC), *M. genavense*, *M. abscessus*, *M. goodii*, *M. kansasii*, and *M. terrae* complex.

Clinical Presentation

One hundred NTM species have been identified, with approximately 40% of them associated with human disease. Thus, symptoms associated with an NTM infection can be very diverse. They include disseminated disease (fever, weight loss, fatigue; commonly found in immunosuppressed individuals); pulmonary disease resembling tuberculosis; lymphadenitis; Crohn's Disease; joint, bone, and soft tissue infections; Buruli ulcer; and sepsis. *M. kansasii* is the most pathogenic bacteria, generally resulting in lung lesions similar to that of tuberculosis.

Diagnosis

Diagnostic tools may be used in consultation with the Public Health Lab, 777-6583 or website www.publichealthlab.ca

Epidemiology

Occurrence

Although NTM is found worldwide, its prevalence is higher in developed countries. The incidence of NTM in Canada has been increasing, due to improved means of detecting and reporting bacteria, but also due to a true increase in the number of infections. Since NTM is not reportable in the United States or Canada, the exact prevalence of infections is unknown. In Newfoundland and Labrador, 37 cases have been reported between 2012 and 2015. The majority of cases of NTM in Newfoundland and Labrador were caused by MAC.

These opportunistic bacteria affect individuals with pre-existing conditions. NTM has been frequently found in HIV/AIDS patients and other immunocompromised groups, such as the elderly and cystic fibrosis patients.

Reservoir

Many species of NTM have been located in water sources, including natural water, tap water, swimming pools, soil, water from showerheads, water in surgical solutions, and plumbing. *M. avium* has been isolated from cigarette components. NTMs have also been located in healthcare settings, including dental practices, dialysis units, and hospital water supplies.

Transmission

There has been no evidence of person-to-person transmission. NTM is acquired through ingestion, aspiration or inoculation of the bacteria from contaminated water sources or soil.

Incubation Period

There is a great deal of variability in incubation period from one NTM to the next. *M. abscessus*, *M. chelonae*, and *M. fortuitum* are among some bacteria that are rapidly growing, with symptoms appearing shortly after infection. However, MAC, *M. genavense*, *M. gordonae*, *M. kansasii*, *M. terrae* complex, and *M. ulcerans* are bacteria that are slow growing with symptoms appearing later. Presentation of symptoms from *M. ulcerans* infection, for example, does not appear until 6-24 weeks after initial infection.

Communicability

Infection with NTM can occur as long as it is active and present in nature. If an individual is immunocompromised, he/she is considered susceptible to infection.

Control Measures

Management of Case

Investigations

- Determine the possible source of the infection taking into consideration the incubation period, reservoir and mode of transmission.
- Determine history of daycare or hospitals.
- Identify potentially contaminated water source. .Identify others who may have exposed to the same source.

Treatment

- Cases should be carefully evaluated to determine the significance of an NTM isolate. NTM may be drug resistant, encouraging the organism's growth. Drug susceptibility tests on a bacterial isolate can help determine an effective drug combination.

- The 11th chapter of the 7th Edition of the Canadian Tuberculosis Standards provides comprehensive information regarding different means of pharmacotherapy for different NTM strains, as well as different treatment methods depending on the symptoms one presents. More information on NTM can be found at http://www.respiratoryguidelines.ca/sites/all/files/Canadian_TB_Standards_7th_Edition_ENG.pdf

Management of Contacts

Investigation of contacts is not required.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

Acceptable hygiene measures should be encouraged for the general public. However, prevention should be aimed at those most at risk for NTM infections.

Overall, it is difficult to prevent acquisition of NTM if it is prevalent in nature. Precautionary measures can be utilized to reduce likelihood of this event occurring. Many NTMs are resistant to chlorinating and ozonating water, as well as extremely cold and moderately hot temperatures. Baths can be taken instead of showers, and water from public supplies should be boiled before human use. To prevent nosocomial infections, there should be proper sterilization of surgical equipment and frequent testing of water supplies within the hospital setting.

Information regarding water quality is provided at

<http://www.health.gov.nl.ca/health/publichealth/envhealth/drinkingwater.html>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries.

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

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2.11 Norovirus Infection

Etiology

Noroviruses, also known as Norwalk-like viruses, SRSV (small round structured viruses, are part of a group of viruses from the family *Caliciviridae* that are the most common cause of stomach upset (gastroenteritis).

Case Definitions

Confirmed Outbreak

Two or more cases of clinical illness⁸ compatible with norovirus that can be epidemiologically linked to one another (i.e. associated by exposure with onsets within a 1-3 day period), at least one of which is laboratory-confirmed:

- Community outbreak:
Two or more unrelated* cases of illness compatible with norovirus that can be epidemiologically linked to one another
* Do not live in a same household, excluding institutions
- Institutional outbreak:
Two or more unrelated⁹ cases of illness compatible with norovirus that can be epidemiologically linked to one another

Clinical Presentations

Noroviruses also known as Norwalk-like viruses (NLV) are a common cause of outbreaks of viral gastroenteritis. Norovirus gastroenteritis has several distinguishing characteristics which include a rapid onset of the following symptoms; diarrhea, vomiting which is often projectile, a short duration of illness (one to three days) and a short incubation period. The illness is generally mild, but it can cause severe disease with associated dehydration and electrolyte imbalance that might require hospitalization and aggressive treatment with intravenous fluids. Relapse is uncommon, but recognized, and mortality rates are low, even in hospital outbreaks.

Diagnosis

Collection of stool sample from the first 10 patients for viral studies and the first three patients for bacteriologic analysis is recommended. Once norovirus has been identified in an outbreak, further fecal specimens are not required.

⁸ Clinical illness is characterized by acute onset of nausea, vomiting, diarrhea, abdominal pain, myalgia, headache, malaise, low grade fever or a combination of these symptoms, lasting 24 to 48 hours.

⁹ Do not live in a common household, excluding institutions

Other diagnostic tools may be used in consultation with the Public Health Lab, 777-6583 or website www.publichealthlab.ca.

Epidemiology

Occurrence

Noroviruses have a worldwide distribution with multiple antigenic types circulating simultaneously in the same region. Outbreaks have been detected in all age groups and tend to occur in closed populations, such as hospital units, child care centers and on cruise ships. The attack rate is around 50% and the infective dose is as small as one to ten virus particles. There have been 71 cases reported in 2015 in Newfoundland and Labrador.

Reservoir

Humans are the natural reservoir for noroviruses and are the source of infection.

Transmission

Transmission is facilitated through person to person spread by the fecal-oral route but there may be aerosolisation of vomitus, which typically contains abundant infectious virus particles.

Common-source outbreaks have been described after ingestion of ice, shellfish, salads, and cookies, usually contaminated by infected food handlers. Exposure to contaminated surfaces has also been implicated in some outbreaks.

Incubation Period

The incubation period is usually twenty four (24) – forty eight (48) hours.

Communicability

Excretion lasts five (5) – seven (7) days after the onset of symptoms in 50% of infected people and can be prolonged in immunocompromised hosts.

Control Measures

Management of Case

Investigations

- Obtain a food history,
 - identify recent ingestion of potentially contaminated food (especially poultry, beef, pork) or water, or unpasteurized milk and the time of consumption.
- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission.
- Assessing for possible cross contamination (e.g., cutting boards).
- Determine occupational exposure (e.g., animal or meat handling).
- Identify history of recent travel especially to areas with inadequate sanitation, water and sewage treatment.

- Assess for history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- Identify recent illness in pets or acquisition of a puppy or kitten into the household.
- Assess for history of similar symptoms in other members of the household.
- Suspected contaminated food may be held to prevent of consumption.
- Suspected contaminated food may be destroyed.
- Identify contacts. Contacts include:
 - persons living in the household,
 - children and childcare workers in a daycare,
 - individuals exposed to the same source (if it is identified).

Treatment

Place the case on contact precautions and encourage fluids to maintain hydration. Fluid and electrolyte replacement may be needed in severe cases.

Exclusion

Exclusion (staying away from school or work) is recommended for symptomatic individuals who work handling food, or who work with infants, the elderly, the immunocompromised and with institutionalized patients or residents. Advise work restrictions until the case has been symptom free for 48 hours.

Management of Contacts

Identify the contacts and provide education regarding the signs and symptoms of infection and preventative measures.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

- Implement measures applicable to diseases transmitted via the fecal-oral route
- Advise strict adherence to hand hygiene measures with an increased educational focus on recommendations as to when and how to wash hands
- Promote enhanced environmental cleaning of frequently touched surfaces
- Review the preparation and cooking of shellfish to prevent infection from that source
- Provide fact sheet available at http://www.health.gov.nl.ca/health/publichealth/envhealth/norovirus_2011.pdf

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)

- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

Nordqvist, Christian. "What Is Norovirus Infection? What Causes Norovirus Infection?." *Medical News Today*. MediLexicon, Intl., 13 Feb. 2010. Web. 31 May. 2013. Retrieved June 6th, 2013, from <http://www.medicalnewstoday.com/articles/179107.php>

2.12 Paralytic Shellfish Poisoning

For more information, please visit

<http://www.bccdc.ca/health-info/diseases-conditions/paralytic-shellfish-poisoning>

2.13 Rotavirus

Etiology

Rotavirus is a genus of double-stranded RNA virus in the family *Reoviridae*. There are five species of this virus, referred to as A, B, C, D, and E. *Rotavirus A*, the most common species, causes more than 90% of infections in humans.

Case Definitions

Confirmed Case

Clinical illness with laboratory confirmation of infection:

Identification of virus in stool by electron microscopy, ELISA, latex agglutination or molecular methods when available.

Probable Case

Clinical illness in a person who is epidemiologically linked to a confirmed case.

Clinical Presentation

Rotavirus infection is primarily characterized by fever, vomiting, and watery, non-bloody diarrhea. This large loss of water can lead to severe dehydration, electrolyte imbalance, and potentially death.

Diagnosis

Demonstration of rotavirus antigen in stool specimens. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Rotavirus causes one-third of gastroenteritis-related hospitalizations in children throughout the world, with a greater prevalence in developing countries. Virtually all children are infected with rotavirus before the age of three. The global child mortality rate due to rotavirus infection is between 600,000 and 870,000 deaths per year. The Canadian Immunization Monitoring Program, Active (IMPACT) recorded 1359 hospitalizations in children between January 2005 and December 2007 due to rotavirus infection. These hospitalizations were solely recorded in 12 hospitals taking part in IMPACT. The mean age of hospitalization was 2.4 years. Between 2006 and 2010 in Newfoundland and Labrador, there has been an average of 35.4 cases per year. There is a large variety in the number of cases of rotavirus that appear from year-to-year in this province. 145 cases were noted in 1999 while seven (7) were reported in 2010. In this province, rotavirus operates in a seasonal pattern with greater prevalence of cases during the winter months.

Reservoir

The reservoir is most likely humans. Group A, B, and C rotavirus species have been found to infect both humans and animals, but no interspecies transmission has been noted. It is important to remain vigilant of the possibility of this means of transmission.

Transmission

The most common mode of transmission of rotavirus is the fecal-oral route. Rotavirus can also be transmitted through contaminated water. It is also believed that rotavirus can be spread through respiratory contact.

Incubation Period

The incubation period is between one to three days.

Communicability

Rotavirus shedding rate is the highest during the diarrheal stage of the disease, which occurs during the first two to five days of illness. It is not generally detectable eight (8) days after onset of illness, but viral shedding has been known to occur up to thirty (30) days after onset of illness in immunocompromised patients.

Control Measures**Management of Case*****Investigations***

- Obtain a food history when foodborne transmission is suspected,
 - Identify recent ingestion of potentially contaminated food (especially poultry, beef, and pork) or water, or unpasteurized milk and the time of consumption.
- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission.
- Assessing for possible cross contamination (e.g. cutting boards).
- Determine occupational exposure (e.g., animal or meat handling).
- Identify history of recent travel especially to areas with inadequate sanitation, water and sewage treatment.
- Assess for history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- Identify recent illness in pets or acquisition of a puppy or kitten into the household.
- Assess for history of similar symptoms in other members of the household.
- Suspected contaminated food may be held to prevent of consumption.
- Suspected contaminated food may be destroyed.
- Contact precautions should be used for hospitalized children and for hospitalized adults who have poor hygiene or incontinence.
- Rotavirus vaccine was introduced for all children born in July 2015 and is administered at two and four months of age.

Treatment

In most cases of rotavirus infection, oral rehydration therapy with oral glucose-electrolyte solution is a sufficient method of treatment. Zinc may be given to children less than five years of age. Cases may need to be kept in isolation.

Exclusion

Exclusion (staying away from school or work) is recommended for symptomatic individuals who work handling food, or who work with infants, the elderly, the immunocompromised and with institutionalized patients or residents. Advise work restrictions until the case has been symptom free for 48 hours.

Management of Contacts

Contact investigation should be initiated and a search for the source of infection in high-risk populations. Furthermore, caretakers of children with rotavirus infection need to adopt strict hygienic control measures for their own protection against rotavirus.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

The following are several steps that can be taken to prevent acquisition of rotavirus:

- Rotavirus vaccination is part of the routine childhood immunization schedule in Newfoundland and Labrador.
- Water chlorination can inactivate rotavirus.
- Ensure that children wear overalls over diapers in daycare settings.
- Oral administration of immunoglobulin has been shown to be effective in protecting immunocompromised neonates and neonates with low birth weights.
- Strict adherence to hygiene protocols.
- More information available at <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/rotavirus-eng.php>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.

- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

Public Health Agency of Canada. Human Rotavirus. Retrieved June 9th, 2013, from <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/rotavirus-eng.php>

2.14 Salmonellosis

Etiology

Salmonellosis is caused by gram negative non-spore forming bacilli belonging to the *Enterobacteriaceae* family. There are more than 2460 serotypes. The most common serotypes that cause human disease are divided among the O-antigen groups A through E. *Salmonella* serotype Typhimurium (serotype B) and *E. Salmonella* serotype Enteritidis (serotype D) are the most commonly reported human isolates.

Case Definition

Confirmed Case

Laboratory confirmation of infection with or without clinical illness:

- Isolation of *Salmonella sp.* (excluding *Salmonella* Typhi) from an appropriate clinical specimen (e.g. sterile site, deep tissue wounds, stool, vomit or urine)

Probable Case

Clinical illness¹⁰ in a person who is epidemiologically linked to a confirmed case

Clinical Presentation

Salmonella organisms can cause asymptomatic carriage, gastroenteritis, bacteremia and focal infections such as meningitis and osteomyelitis. The most common illness associated with a *Salmonella* infection is gastroenteritis, in which diarrhea, abdominal cramps, and fever are common manifestations. The site of infection usually is the small intestine but colitis can occur. The illness usually lasts 4 to 7 days and most people recover without treatment. The very young, the elderly and immunosuppressed persons are more at risk for complications.

Diagnosis

The diagnosis is made through the isolation of *Salmonella* from feces, rectal swabs or other body fluids. Freshly passed stool is preferred. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Salmonellosis occurs worldwide and it is generally considered a foodborne disease. There are over 2460 serotypes which cause human diseases but the two most common

¹⁰ Clinical illness is characterized by headache, diarrhea, abdominal pain, nausea, fever and sometimes vomiting. Asymptomatic infections may occur, and the organism may cause extra-intestinal infections.

serotypes recovered in Canada are *Salmonella Enteritidis* and *Salmonella Typhimurium*. It is estimated that only 1% of clinical cases are reported. From 2000 to 2004 rates of salmonellosis have ranged from 16.0 – 19.6/100,000 in Canada. In Newfoundland and Labrador during the same period the rate ranged from 5.4 -10.5/100,000. In 2015, 73 cases of salmonellosis were reported in NL.

Reservoir

Salmonella species are widely present in animal reservoirs including poultry, birds, reptiles, livestock, rodents, pets; such as iguanas, tortoises, turtles, dogs and cats; also humans.

Transmission

The major mode of transmission is fecal oral route. (i.e. ingestion of food or water contaminated with animal or human feces). Another source of transmission is food of animal origin, such as poultry, beef, eggs, and dairy products. Other food vehicles (e.g., fruits, vegetables, and bakery products) have been implicated in outbreaks, in which the food was contaminated by contact with an infected animal product or human. Other modes of transmission include ingestion of contaminated water; contact with infected reptiles or amphibians and possibly rodents; and exposure to contaminated medications, dyes, and medical instruments.

Incubation Period

The incubation period is from 6 to 72 hours, usually 12-36 hours.

Communicability

The risk of human-to-human transmission exists for the duration of fecal excretion of organisms.

Control Measures

Management of Case

Investigations

- Obtain a food history using the appropriate questionnaire to determine recent consumption of potential sources (e.g., undercooked poultry, eggs, dairy products, sprouts, etc.).
- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission.
- Identify history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- If necessary, identify history of high risk sexual practices, especially contact with feces.
- Determine history of exposure to pets or farm animals that may harbor the disease.
- Assess for history of similar symptoms in other members of the household.
- Hold suspected contaminated food to prevent of consumption and illness.
- Have suspected contaminated food destroyed.

Exclusion

- Exclusion (staying away from school or work) should be considered for symptomatic and asymptomatic cases who are:
- Food handlers whose work involves:
 - touching unwrapped food to be consumed raw or without further cooking and/or
 - handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking.
- Healthcare, daycare or other staff who have contact through serving food with highly susceptible patients or persons, who, in an intestinal infection would have particularly serious consequences,
- Involved in patient care or care of young children, elderly or dependent persons,
- Children attending daycares or similar facilities who are diapered or unable to implement good standards of personal hygiene, and
- Older children or adults who are unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- Advise the case of the work restrictions until the case has been symptom free for 48 hours.
- Reassignment to a low risk area may be used as an alternative to exclusion.

Treatment

- Rehydration and electrolyte replacement should be provided.
- Antibiotic treatment may be recommended by a physician. Antibiotic therapy may be recommended for:
 - individuals with severe disease,
 - individuals with systemic illness including septicemia,
 - the very young (< two months), elderly, and debilitated persons,
 - individuals with cardiac valvular or endovascular abnormalities,
 - persons with HIV, and
 - individuals with other immunocompromised states.
- The use of antibiotics is often not effective in eradicating the carriage of *Salmonella* if anatomic abnormalities (i.e., biliary or kidney stones) are present.

Management of Contacts

- Symptomatic contacts must be referred for investigation. Investigation of contacts should include stool cultures of any household contacts who are involved in food handling, direct patient care, or care of young children or elderly people in institutional settings.
- Contacts should be given information on disease transmission and appropriate personal hygiene.

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to

manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

- Educate the public about good sanitation and personal hygiene
- Food establishments should ensure compliance with the *Food Premises Regulations*.
- Follow the clean, separate, cook and chill rules
 - Clean: wash hands and surfaces often
 - Wash hands before and after handling food and after using the bathroom, changing diapers, and handling pets.
 - Wash utensils, cutting boards, dishes, and countertops after preparing each food item and before you go on to the next item
 - Separate: Don't cross-contaminate
 - Separate raw meat, poultry, and seafood from other foods in the grocery shopping cart and in the refrigerator.
 - Always wash cutting boards, dishes, countertops, and utensils after they come in contact with raw meat, poultry, and seafood.
 - Never place cooked food on a plate that previously held raw meat, poultry, or seafood
 - Cook: Cook to safe temperatures
 - Use a clean food thermometer when measuring the internal temperature of meat, poultry, casseroles, and other foods to make sure they have reached a safe minimum internal temperature
 - Do not eat or drink foods containing raw eggs, or unpasteurized milk
 - Chill: Refrigerate promptly
 - Keep food safe at home, refrigerate promptly and properly. Refrigerate or freeze perishables, prepared foods, and leftovers within 2 hours (1 hour if temperatures are above 90 °F)
 - Freezers should register 0 °F or below and refrigerators 40 °F or below
 - Thaw food in the refrigerator, in cold water, or in the microwave. Foods should not be thawed at room temperature
 - Foods thawed in the microwave or in cold water must be cooked to a safe minimum internal temperature before refrigerating
 - Marinate foods in the refrigerator
 - Divide large amounts of leftovers into shallow containers for quick cooling in the refrigerator
 - Don't pack the refrigerator. Cool air must circulate to keep food safe
- Provide a fact sheet available at
http://www.health.gov.nl.ca/health/publichealth/envhealth/Salmonellosis_Food_Safety_Jan_2011.pdf

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

Foodborne Pathogenic Microorganisms and Natural Toxins – Salmonellosis spp. US Food and Drug Administration Centre for Food Safety and Applied Nutrition. Bad Bug Book. January 1992. Retrieved June 3rd, 2013, from <http://www.fda.gov/downloads/Food/FoodSafety/FoodborneIllness/FoodborneIllnessFoodbornePathogensNaturalToxins/BadBugBook/UCM297627.pdf>

2.15 Shigellosis

Etiology

Shigellosis is an acute bacterial disease caused by gram negative bacilli in the *Enterobacteriaceae* family. It is the most communicable of the bacterial diarrheas. Some strains produce enterotoxin and shigatoxin (much like the verotoxin of *E. coli* O157:H7). Approximately 40 serotypes are divided into four groups depending on serologic similarity and fermentation reactions:

Group A - *Shigella dysenteriae*

Group B - *Shigella flexneri*

Group C - *Shigella boydii*

Group D - *Shigella sonnei*

Case Definition

Confirmed Case

Laboratory confirmation of infection with or without clinical illness:

- isolation of *Shigella* sp. from an appropriate clinical specimen (e.g. sterile site, deep tissue wounds, stool, vomit or urine)

Probable Case

Clinical illness¹¹ in a person who is epidemiologically linked to a confirmed case

Clinical Presentation

Shigellosis is unique among bacterial enteropathogens in that a very low dose of the organism readily produces disease in humans. This may account for the high secondary attack rate in families. The severity of the presentation and case fatality rates are functions of the host.

Shigellosis involves the large and distal small intestine. Disease is most commonly characterized by diarrhea (may contain blood and mucus or be watery) accompanied by fever, nausea, and tenesmus. It may be biphasic with an initial period of watery diarrhea and cramps followed by the development of dysentery (blood and mucus). Febrile convulsions may be a significant complication in young children. The illness is usually self-limited lasting between one day and one month with an average of seven days. Some individuals have mild or asymptomatic infections. Bacteremia and pneumonia may occur but are uncommon.

There is a rare fulminant form of bacillary dysentery secondary to a massive small intestine invasion by the bacteria. This may be seen in children. Death early in the infection is common (the “Ikari” syndrome).

¹¹ Clinical illness is characterized by diarrhea, fever, nausea, vomiting cramps and tenesmus. Asymptomatic infections may occur.

Infection with *S. dysenteriae* is often associated with serious disease and more severe complications. This can include toxic megacolon and hemolytic-uremic syndrome (HUS). It is one of the most common *Shigella* species to occur in developing countries and least common in developed countries.

Some strains of *S. flexneri* can cause Reiter's syndrome (reactive arthropathy) in persons who are genetically predisposed, although Reiter's syndrome can occur with any of the *Shigella* strains. This is a common strain in developing countries but also accounts for approximately one quarter of cases in the US.

S. boydii is not a common isolate in North America but widespread in developing countries.

Infection with *S. sonnei* often results in a short clinical course. Infection may be fatal in immunocompromised individuals.

Diagnosis

Diagnosis is made by the isolation of *Shigella* from feces or a rectal swab. The infection is generally associated with a high number of leukocytes (pus cells) in the fecal matter. *Shigella* remains viable outside the human body for only a short period of time hence, specimens must be processed rapidly after collection, preferable within 24 hours. Use of appropriate media increases the likelihood of organism isolation.

Serological testing is not generally helpful. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Shigellosis occurs worldwide, a rate of 1.93 per 100,000 was reported in Canada in 2007. There were no reported cases in NL for 2015. There have been five cases reported in 2012.

Reservoir

Humans are a significant reservoir for this disease.

Transmission

Transmission occurs through the fecal -oral route. Predominated modes of transmission include person-to-person contact, contact with a contaminated inanimate object, ingestion of contaminated food or water. Houseflies also can be vectors through physical transport of infected feces. The infectious dose is very low; 10 to 200 organisms can cause an infection.

Incubation Period

The incubation period is typically two (2) to four (4) days (range one to seven days).

Communicability

Transmission can occur as long as the organism is present in feces usually about four (4) weeks from onset of illness.

Control Measures

Management of Case

Investigations

- Obtain a food history.
- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission.
- Identify history of international travel (especially to areas with inadequate sanitation, water and sewage treatment).
- Determine history of institutionalization.
- Identify history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- Assess for history of similar symptoms in other members of the household.
- Suspected contaminated food may be held to prevent of consumption.
- Suspected contaminated food may be destroyed.

Exclusion

Exclusion (staying away from school or work) should be considered for symptomatic and asymptomatic persons who are:

- Food handlers whose work involves:
 - touching unwrapped food to be consumed raw or without further cooking and/or
 - handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking.
- Healthcare, daycare or other staff who have contact through serving food with highly susceptible patients or persons, who, in an intestinal infection would have particularly serious consequences, involved in patient care or care of young children, elderly or dependent persons.
- Children attending daycares or similar facilities who are diapered or unable to implement good standards of personal hygiene.
- Older children or adults who are unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- Exclusion is patient care until 2 successive fecal samples or rectal swabs are found to be negative.
- Reassignment to a low risk area may be used as an alternative to exclusion.
- Contact precautions should be used in healthcare settings where children or adults have poor hygiene or incontinence that cannot be contained. Otherwise, routine practices are adequate.

Treatment

- Fluids and electrolyte replacement if excessive fluid loss through diarrhea or vomiting.
- Antimotility agents are not recommended as they may prolong the course of disease.
- Treatment is recommended for most symptomatic patients. Use of antibiotics will shorten the period of fecal excretion of the infecting strain and will shorten the clinical course of disease often to a few days.
- Antibiotics are prescribed according to the physician.
- Antibiotic resistance frequently develops after treatment.

Management of Contacts

Symptomatic contacts in child care facilities and in the household of the case should have stool specimens submitted for testing. Information should be given on disease transmission and appropriate personal hygiene.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

General control measures include:

- Strict attention to hand hygiene and personal hygiene
- Proper cooking and storage of food
- People with diarrhea should not use recreational water venues (eg., swimming pools, lakes, rivers, the ocean) for 2 weeks after symptoms resolve
- Breastfeeding provides protection for infants
- Protect, purify and chlorinate public water supplies
- Control flies
- Provide fact sheet available at <http://healthykanadians.gc.ca/eating-nutrition/risks-recalls-rappels-risques/poisoning-intoxication/poisoning-intoxication/shigella-eng.php>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.

- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries.

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

Foodborne Pathogenic Microorganisms and Natural Toxins – Shigellosis. US Food and Drug Administration Centre for Food Safety and Applied Nutrition. Bad Bug Book. January 1992. Retrieved June 3rd, 2013, from <http://www.fda.gov/downloads/Food/FoodSafety/FoodborneIllness/FoodborneIllnessFoodbornePathogensNaturalToxins/BadBugBook/UCM297627.pdf>

2.16 Typhoid and Paratyphoid Fever

Etiology

Typhoid fever is caused by *Salmonella typhi*. At present, 107 types can be distinguished by phage typing, which is valuable in epidemiologic studies.

For paratyphoid fever, three bioserotypes of *S. enteritidis* are recognized: Paratyphi A, Paratyphi B (*S. schottmulleri*), and Paratyphi C (*S. hirschfeldii*). A number of phage types can be distinguished.

Case Definition

Confirmed Case

Clinical illness¹² with laboratory confirmation of infection:

- isolation of *Salmonella typhi* from an appropriate clinical specimen

Clinical Presentation

Typhoid is a systemic bacterial disease. Mild and inapparent illness may occur, especially in endemic areas. Infection is characterized by insidious onset of sustained fever, severe headaches, malaise, anorexia, a nonproductive cough (in the early stage of the illness), a relative bradycardia, and hepatosplenomegaly (50%). Approximately 30% of Caucasians will develop rose spots on the trunk. In adults, constipation is more common than diarrhea (10% to 38%). Only 20% to 40% of people will initially have abdominal pain. Nonspecific symptoms such as chills, diaphoresis, headache, anorexia, cough, weakness, sore throat, dizziness, and muscle pains are frequently present before the onset of fever. Psychosis and confusion occur in 5 to 10% of people. Seizures and coma are reported in less than 1% of those infected.

The usual case-fatality rate of 10% can be reduced to less than 1% with prompt treatment. Relapse occurs in 5% to 10% of untreated cases and is also common (15%–20%) following therapy with appropriate antibiotics.

Paratyphoid, like typhoid, is a systemic bacterial disease. The clinical manifestations tend to be milder, and the case-fatality rate is much lower. Ratio of disease caused by *Salmonella typhi* to that caused *S. paratyphi* is about 10:1. Relapses occur in approximately 3%–4% of cases.

A chronic carrier status is defined as persistence of the organism in stool for more than one year and occurs in 1% to 4% of cases. The carrier state may follow acute illness,

¹² Typhoid is characterized by insidious onset of sustained fever, headache, malaise, anorexia, splenomegaly, constipation or diarrhea, and nonproductive cough. Relative bradycardia and rose spots (less than 25% of individuals) may be seen. Atypical presentations occur and severity of illness varies.

mild or even subclinical infections. It is most common when individuals (especially women) are infected during middle age and in those with biliary tract abnormalities including gallstones.

Diagnosis

The etiologic organisms can be isolated from the blood early in the disease, and from feces after the first week. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Both diseases occur worldwide. They are endemic in many developing countries particularly Africa, Central and South America, and India. The incidence is extremely low in developed countries such as Canada. The risk to Canadians is during travel to endemic areas. An average of 139 cases of typhoid and 108 cases paratyphoid were reported in Canada annually between 2004 and 2006. There have been no cases reported in Newfoundland Labrador since 1991.

Reservoir

The reservoir for typhoid and paratyphoid fever is man; and rarely, domestic animals for paratyphoid fever.

Transmission

Typhoid and paratyphoid transmission occurs when food or water becomes contaminated with the feces and urine of infected individuals and carriers. Transmission can also take place if raw sewage contaminates seafood such as shellfish. The infection is rarely spread by casual contact.

Incubation Period

For typhoid, the incubation period is from three to 60 days (usual range is eight to 14 days) and depends on the size of the infecting dose and host factors. The incubation for paratyphoid fever period is one to ten days.

Communicability

The contagious period is most commonly from one week until the individual is recovered.

Case Measures

Management of Case

Investigations

- Obtain a food history including consumption of shellfish.
- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission.
- Determine history of travel.

- If necessary, determine history of high risk sexual practices especially contact with feces.
- Identify history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- Determine immunization history.
- Identify underlying medical conditions i.e., decreased gastric acidity, HIV infection, organ transplants, and lymphoproliferative disease.
- Determine occupation and attendance at daycare or other type of institutional contact (e.g., continuing care facility).
- Identify symptomatic household members or other close contacts (e.g. travel companions) who have recently travelled to developing countries.
- When paratyphoid is diagnosed, determine ownership of tropical fish and tank.

Exclusion

Exclusion (staying away from school or work) should be considered for symptomatic and asymptomatic cases persons who are,

- Food handlers whose work involves:
 - Touching unwrapped food to be consumed raw or without further cooking and/or
 - Handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking.
- Healthcare, daycare or other staff who have contact through serving food with highly susceptible patients or persons, in whom an intestinal infection would have particularly serious consequences.
- Involved in patient care or care of young children, elderly or dependent persons,
- Children attending daycares or similar facilities who are diapered or unable to implement good standards of personal hygiene.
- Older children or adults who are unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).

The specimens must be taken not earlier than one month after onset of illness, at least 48 hours after completion of antimicrobial therapy, and not less than 24 hours apart.

Treatment

- Supportive care and antibiotics are recommended.
- Short-term, high-dose corticosteroid treatment, combined with specific antibiotics and supportive care, clearly reduced mortality in critically ill patients.

Management of Contacts

All members of a travel group in which a case has been identified should be followed. Symptomatic contacts must be referred for medical evaluation. Information on the disease and infection prevention measures must be given to contacts. Contact precautions should be used for the duration of acute illness as well as with hospitalized children and adults who have poor hygiene or incontinence that cannot be contained. Otherwise, routine infection control precautions are adequate.

Management of Outbreaks

An outbreak management team should be established to direct and coordinate the investigation as well as address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

Prevention is based on access to safe water and proper sanitation as well as adherence to safe food handling practices.

The greatest risk for Canadians is when they travel to areas where this disease is endemic.

Advice to travelers

- Visit a travel clinic prior to traveling
- Emphasize the importance of hand hygiene
- Vaccine information
 - There are two vaccines for typhoid licensed in Canada
 - Vaccinate against typhoid if planning to visit rural areas in countries where typhoid is endemic or if they plan long term visits
 - Vaccines only provide 50 – 60% coverage
- Provide food and water precautions recommendations
 - Eat food served hot
 - Eat fruits and vegetables that have been cooked or peeled
 - Avoid road side food vendors
 - Drink bottled or boiled water

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
- CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada

- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

Public Health Agency of Canada. *Infectious substances - Salmonella enterica*. Office of Laboratory Security. Material Safety Data Sheet. March 2001. Retrieved June 3rd, 2013, from <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/salmonella-ent-eng.php>

2.17 Verotoxigenic *Escherichia Coli*

Etiology

Escherichia coli is a gram-negative bacilli. The bacteria cause illness by creating a toxin referred to as a verotoxin (VTEC) or shiga-like toxin (STEC).

The organism has a low infective dose (10 organisms by ingestion) and is resistant to cold storage, acid conditions, and drying.

Case Definitions

Confirmed Case

Laboratory confirmation of infection with or without clinical illness:

- isolation of verotoxin producing *E. coli* from an appropriate clinical specimen (e.g. feces, urine, blood)

OR

- detection of verotoxin antigen or nucleic acid

Probable Case

Clinical illness¹³ in a person who is epidemiologically linked to a confirmed case, which would include persons with hemolytic uremic syndrome (HUS)

Clinical Presentation

Escherichia coli have more than 30 serotypes which produce verotoxin causing food-borne illness. The best known of these is *E. coli* O157:H7, a gram-negative bacterium. Illness occurs in a two-step process. The first phase is the intestinal phase characterized by acute diarrhea, abdominal cramps, nausea, emesis and occasionally fever. Diarrhea can range from mild and non-bloody to stools that are virtually all blood. The illness is often self-limited, lasting seven to 10 days with an average of eight days. Most individuals recover without residual sequelae.

The second phase is the elaboration of the toxin. It is the action of the toxin on the intestinal cells has the potential to cause complications. The toxin breaks down the lining of the intestines and in some cases, damages the kidneys. This occurs in up to 15% of cases and is most common in children under 14 years of age and the elderly. Complications include hemorrhagic colitis, hemolytic uremic syndrome (HUS: renal failure associated with hemolysis of red blood cells) or thrombotic thrombocytopenic purpura (TTP: hemolytic anemia with thrombocytopenia). The overall case fatality rate is about 1%.

¹³ Clinical illness is characterized by diarrhea (often bloody) and abdominal cramps; fever is often absent. Illness may be complicated by hemolytic uremic syndrome (HUS), thrombocytopenic purpura (TTP) or pulmonary edema. Asymptomatic infections may also occur and the microorganism may cause extra-intestinal infections.

Diagnosis

The diagnosis is made by positive stool, urine and blood culture for *E. coli*. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

First identified in Canada in 1982, the organism has been associated with outbreaks in North America and Europe. The incidence rate for Canada has been relatively consistent for 2001-2004 at 3-4/100,000 population. In Newfoundland Labrador the rate has ranged from 0.18 to 1.75/100,000 during the period 1997– 2004. In 2015, there were 10 reported cases.

Reservoir

Cattle are the most important reservoir; humans may also serve as a reservoir for person-to-person transmission.

Transmission

Transmission is primarily through the ingestion of contaminated food or water. Outbreaks have been associated with various food sources: beef (inadequately cooked ground beef), produce (including melons, lettuce, coleslaw, apple cider, alfalfa sprouts), and unpasteurized dairy milk. Human-to-human transmission can occur in families, child care centers and custodial institutions. Waterborne transmission occurs both from contaminated drinking water and contaminated recreational waters.

Incubation Period

The incubation period is from two to ten days, with a mean of three to four days.

Communicability

Usually one week, but may be up to three weeks in one third of children.

Control Measures

Management of Case

Investigations

- Obtain a food history.
- Determine ingestion of potentially contaminated food and the time of consumption, in particular, undercooked meats (primarily ground beef), unpasteurized milk and juices, raw fruits and vegetables.
- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission.
- Determine history of contact with sewage contaminated recreational water (cattle nearby) or consumption of untreated surface water.

- Determine history of working with animals.
- Assess for recent visit to a farm or petting zoo.
- If necessary, determine history of high risk sexual practices, especially contact with feces.
- Identify history of recent travel.
- Identify history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- Assess for history of similar symptoms in other members of the household.
- Obtain implicated food samples, if possible.
- Suspected contaminated food may be held to prevent consumption.
- Suspected contaminated food may be destroyed.

Exclusion

- Exclusion (staying away from school or work) should be considered for symptomatic and asymptomatic cases who are:
- Food handlers whose work involves:
 - touching unwrapped food to be consumed raw or without further cooking and/or
 - handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking.
- Healthcare, daycare or other staff who have contact through serving food with highly susceptible patients or persons, who, in an intestinal infection would have particularly serious consequences,
- Involved in patient care or care of young children, elderly or dependent persons.
- Children attending daycares or similar facilities who are diapered or unable to implement good standards of personal hygiene.
- Older children or adults who are unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- For patients with HUS, contact precautions should continue until diarrhea resolves and results of two consecutive stool cultures are negative for E coli O157.
- Reassignment to a low risk area may be used as an alternative to exclusion.

Treatment

- The use of antibiotics is not recommended and may be harmful by enhancing the release of toxins.
- Antimotility agents should be avoided.
- Replace fluids and electrolytes as required.

Management of Contacts

Symptomatic contacts should be treated as cases. Cultures must be submitted to establish the diagnosis. Education must be provided to all contacts on the preventative measures.

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

- Prompt involvement of community health is essential Search intensively for the specific vehicle (food or water) of disease transmission if; foodborne outbreaks, a food recall may be necessary.
- Waterborne outbreak is suspected; an order to boil water is indicated.
- Swimming-associated outbreak is suspected, the pool or beaches affected must be closed.
- Drinking unpasteurized milk, pasteurization or boiling of the milk is recommended.
- Education of case/s and contacts on the importance of hygienic measures.
- Hand washing is the single most important way to prevent infection.
- Follow the Canadian Food Inspection Agency's 4 point plan for food safety;
- **Clean start** – Clean your hands before and after handling food, clean your countertop and utensils before and after preparing foods, wash fruits and vegetables with water before you prepare and eat them.
- **Chill your food** – keep cold food at or below 4°C.
- **Cross-contamination is to be avoided** – Separate raw meats from cooked meats; platters, utensils and cutting boards for raw meats must not be used for cooked meats; and separate raw foods from ready-to-eat foods while shopping, storing or preparing foods.
- **Cook safely** – Cook meat to a safe internal temperature; use a food thermometer – hamburgers can turn brown inside before they have been cooked safely; consult a safe cooking temperature chart for meats.
- Ensure that slaughterhouse operations meet recommended standards.
- Wash hands after contact with farm animals or the farm environment.
- Pasteurize milk and dairy products.
- Protect, purify and chlorinate public water supplies including swimming pools.
- Fact sheet available at http://www.health.gov.nl.ca/health/publichealth/envhealth/E_coli_Food_Safety_Jan_2011.pdf

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease

- control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
 - CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

Foodborne Pathogenic Microorganisms and Natural Toxins Handbook – Enterotoxigenic Escherichia coli. US Food and Drug Administration. Centre for Food Safety and Applied Nutrition. Bad Bug Book. January 1992. Retrieved June 3rd, 2013, from <http://www.fda.gov/downloads/Food/FoodSafety/FoodborneIllness/FoodborneIllnessFoodbornePathogensNaturalToxins/BadBugBook/UCM297627.pdf>

Public Health Agency of Canada. *Infectious substances: Escherichia coli*. Office of Laboratory Security. Material Safety Data Sheet. January 2001. Retrieved June 3rd, 2013, from <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/escherichia-coli-eng.php>

2.18 Appendix A, Food History

Form C-Clinical Data, Food History & Common Sources Report Form

SECTION 1: CLINICAL DATA (Complete for all cases)

Reported By:	Date Reported:	Client's Phone Number: Work: Home:
Client Name:	Age	MCP #
Home Address:	Female <input type="checkbox"/> Male <input type="checkbox"/>	Next of Kin:

Disease Name, if Known: _____ Laboratory Confirmed: <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, Date lab confirmed: _____ Hospital Lab <input type="checkbox"/> Public Health Lab <input type="checkbox"/> Other <input type="checkbox"/> (Please identify) _____	Date specimen collected: (month/day/year) Type of specimen obtained:
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Attending Physician Consulted:	Address:	Tel:
Family Physician :	Address:	Tel:

Case Ill: <input type="checkbox"/> Yes <input type="checkbox"/> No Case Notified of Illness: <input type="checkbox"/> Yes <input type="checkbox"/> No	Hospitalized: <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, Dates: Hospital:
--	--

Occupation: (Identify if case is a food handler, child care, adult care or health care worker)	Place of Work:
Date of Onset of Symptoms: (month/day/year)	Duration of Illness: <input type="checkbox"/> Ongoing (days)
Time of Onset of Symptoms: (include A.M. or P.M.)	Incubation Period: <input type="checkbox"/> Unknown (hours)

Medications Prescribed for Illness: <input type="checkbox"/> Yes <input type="checkbox"/> No	Type:	Amount	Date Started: (month/day/year)	Duration: (Days)
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Known Allergies:	Special Dietary Habits, etc.:	Medication/Vaccine Prior to Illness:
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Intoxication	Enteric Infections	Generalized Infections	Localized Infections	Neurological Illnesses
nausea	abdominal cramps	lack of appetite	ear	blurred vision

<input type="checkbox"/>	vomiting	<input type="checkbox"/>	diarrhea	<input type="checkbox"/>	headache	<input type="checkbox"/>	eye	<input type="checkbox"/>	dizziness
<input type="checkbox"/>	bloating	<input type="checkbox"/>	bloody <input type="checkbox"/>	<input type="checkbox"/>	muscular aching	<input type="checkbox"/>	itching	<input type="checkbox"/>	numbness
<input type="checkbox"/>	dehydration	<input type="checkbox"/>	mucoid <input type="checkbox"/>	<input type="checkbox"/>	perspiration	<input type="checkbox"/>	mouth	<input type="checkbox"/>	tingling
<input type="checkbox"/>		<input type="checkbox"/>	greasy <input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
<input type="checkbox"/>	weight loss	<input type="checkbox"/>	water <input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
<input type="checkbox"/>		<input type="checkbox"/>	No. / day:	<input type="checkbox"/>	chills	<input type="checkbox"/>	malaise	<input type="checkbox"/>	rash
<input type="checkbox"/>	other:	<input type="checkbox"/>	fever	<input type="checkbox"/>	weakness	<input type="checkbox"/>	skin lesion	<input type="checkbox"/>	difficulty swallowing
<input type="checkbox"/>		<input type="checkbox"/>	Constipation	<input type="checkbox"/>	other:	<input type="checkbox"/>	describe:	<input type="checkbox"/>	difficulty breathing
<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	other:

Signs and Symptoms: (check appropriate signs and symptoms and circle those that occur first)

EHO Comment: Any Attempted call(s) or visit(s)? ☐ yes ☐ no If yes, please list date(s) & time(s)

SECTION 2: OPEN-ENDED FOOD HISTORY

Instructions: Please note that the detailed length of the food history will depend upon the maximum incubation period of the infectious agent. If infectious agent is unknown, please complete a 3 day food history. If you are unable to obtain at least 50 % or more of the meals for the required length of the food history then Section 3 must be completed

Please try to remember what you may have eaten in the days before you started feeling sick. We'll start with the day you got sick and work backwards. (If a meal was eaten out, specify where.)

DAY OF ILLNESS- Date: _____

Breakfast Place: Hours: Items consumed: <input type="checkbox"/> Unable to Recall	Lunch Place: Hours: Items consumed: <input type="checkbox"/> Unable to Recall	Dinner Place: Hours: Items Consumed: <input type="checkbox"/> Unable to Recall	Snacks/Water Ingested Place: Hours: Items Consumed: <input type="checkbox"/> Unable to Recall
Companions at meal (ill and well)	Companions at meal (ill and well)	Companions at meal (ill and well)	Companions at meal (ill and well)
Comments:			

DAY BEFORE ILLNESS- Date: _____

Breakfast Place: Hours: Items consumed: <input type="checkbox"/> Unable to Recall	Lunch Place: Hours: Items consumed: <input type="checkbox"/> Unable to Recall	Dinner Place: Hours: Items consumed: <input type="checkbox"/> Unable to Recall	Snacks/Water ingested Place: Hours: Items consumed: <input type="checkbox"/> Unable to Recall
Companions at meal (ill and well)	Companions at meal (ill and well)	Companions at meal (ill and well)	Companions at meal (ill and well)
Comments:			

Instructions: Please photocopy this page if the detailed length of the required food history is greater than three days before illness

DAYS BEFORE ILLNESS- Date: _____

Breakfast Place _____ Hour: _____ Items Consumed: <input type="checkbox"/> Unable to Recall	Lunch Place _____ Hour: _____ Items Consumed: <input type="checkbox"/> Unable to Recall	Dinner Place _____ Hour: _____ Items Consumed: <input type="checkbox"/> Unable to Recall	Snacks/Water Ingested Place _____ Hour: _____ Items Consumed: <input type="checkbox"/> Unable to Recall
Companions at meal (ill and well)	Companions at meal (ill and well)	Companions at meal (ill and well)	Companions at meal (ill and well)
Comments:			

SECTION 3: SPECIFIC FOOD ITEMS

Instructions: Please complete this section, if you are unable to obtain a satisfactory detailed food history from Section 2 or directed by the Regional Medical Officer of Health. Please note that a satisfactory detailed food history is defined as obtaining information from at least 50 % or more of the meals for the required length of the food history

Now, I'd like to ask about specific food items. Did you eat any of the following during the week before your illness?

Comments (variety/brand, how prepared, where bought/eaten, etc.)
 dk/ns (don't know/not specified)

Dairy Products

Milk, unpast	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Icecream, unpast	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Yogurt, unpast	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Cheese, unpast	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Soft cheeses	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
brie	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
queso fresco	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
cottage	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
cream	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
feta	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
mozzarella	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
ricotta	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
other (soft)	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
specify	_____			
Other cheeses	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	
specify	_____			

Fish, Poultry, and Meats

Comments (variety/brand, how prepared, where bought/eaten, etc.)

Fish	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Shellfish	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
(shrimp, lobster, clams, etc., specify)				
Chicken	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Turkey	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Pork	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Veal	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Lamb	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Moose	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Caribou	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Rabbit	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Other Venison	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	specify _____
Sausage	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Hot dog	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Beef jerky	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Dried salami	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Steak	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Roast beef	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	_____
Other beef	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns	specify _____

Ground Meats

Ground Beef ☐ yes ☐ no ☐ dk/ns

If yes, was item eaten at home or out? ☐ at home ☐ out, where _____
☐ both

How was the item cooked? ☐ rare (red in middle) ☐ medium (pink in middle)
☐ well done (no pink)

For item eaten in the home, was it made from (also ask where item was purchased from,, % fat, etc):

Fresh (never frozen) raw food item ☐ yes ☐ no ☐ dk/ns

Previously frozen raw food item ☐ yes ☐ no ☐ dk/ns

Pre-made uncooked patties ☐ yes ☐ no ☐ dk/ns

Pre-made, pre-cooked patties ☐ yes ☐ no ☐ dk/ns

Other ground item such as in a taco, meatloaf, etc. ☐ yes ☐ no ☐ dk/ns

If yes, specify dish _____, eaten at home or out, where _____

Ground Chicken/Turkey ☐ yes ☐ no ☐ dk/ns

If yes, was item eaten at home or out? ☐ at home ☐ out, where _____
☐ both

How was the item cooked? ☐ rare (red in middle) ☐ medium (pink in middle)
☐ well done (no pink)

For item eaten in the home, was it made from (also ask where item was purchased from,, % fat, etc):

Fresh (never frozen) raw food item ☐ yes ☐ no ☐ dk/ns

Previously frozen raw food item ☐ yes ☐ no ☐ dk/ns

Pre-made uncooked patties ☐ yes ☐ no ☐ dk/ns

Pre-made, pre-cooked patties ☐ yes ☐ no ☐ dk/ns

Other ground items such as in a taco, meatloaf, etc. ☐ yes ☐ no ☐ dk/ns

If yes, specify dish _____, eaten at home or out, where _____

Ground Pork ☐ yes ☐ no ☐ dk/ns

If yes, was item eaten at home or out? ☐ at home ☐ out, where _____
☐ both

How was the item cooked? ☐ rare (red in middle) ☐ medium (pink in middle) ☐
well done (no pink)

For item eaten in the home, was it made from (also ask where item was purchased from,, % fat, etc):

Fresh (never frozen) raw food item ☐ yes ☐ no ☐ dk/ns

Previously frozen raw food item ☐ yes ☐ no ☐ dk/ns

Pre-made uncooked patties ☐ yes ☐ no ☐ dk/ns

Pre-made, pre-cooked patties ☐ yes ☐ no ☐ dk/ns

Other ground items such as in a taco, meatloaf, etc. ☐ yes ☐ no ☐ dk/ns

If yes, specify dish _____, eaten at home or out, where _____

Other Ground Meats ☐ yes ☐ no ☐ dk/ns

If yes, please specify type _____

If yes, was item eaten at home or out? ☐ at home ☐ out, where _____
☐ both

How was the item cooked? ☐ rare (red in middle) ☐ medium (pink in middle)

☐ well done (no pink)

For item eaten in the home, was it made from (also ask where item was purchased from, % fat, etc):

Fresh (never frozen) raw food item ☐ yes ☐ no ☐ dk/ns

Previously frozen raw food item ☐ yes ☐ no ☐ dk/ns

Pre-made uncooked patties ☐ yes ☐ no ☐ dk/ns

Pre-made, pre-cooked patties ☐ yes ☐ no ☐ dk/ns

Other ground item such as in a taco, meatloaf, etc. ☐ yes ☐ no ☐ dk/ns

If yes, specify dish _____, eaten at home or out, where _____

Salads and Vegetables

Comments (variety/brand, how prepared where bought/eaten, etc.)

Cole slaw ☐ yes ☐ no ☐ dk/ns

Pasta salad ☐ yes ☐ no ☐ dk/ns

Potato salad ☐ yes ☐ no ☐ dk/ns

Pre-packaged/Pre-bagged salad or lettuce
specify type/brand ☐ yes ☐ no ☐ dk/ns

Lettuce ☐ yes ☐ no ☐ dk/ns

(loose leaf, whole heads, not bagged)

Iceberg ☐ yes ☐ no ☐ dk/ns

Green leaf ☐ yes ☐ no ☐ dk/ns

Red leaf	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Romaine	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Mesclun	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Other type _____	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns specify
Alfalfa sprouts	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Bean sprouts	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Other sprouts specify type _____	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Carrots specify type (large, baby)	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Cabbage	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Celery	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Spinach	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Tomatoes specify type (large, plum, cherry) _____	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Onions	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Radishes	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Green onions	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Parsley	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Cilantro	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Basil	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns

Fresh Fruits Comments (variety/brand, how prepared where bought/eaten, etc.)

Watermelon (whole or precut?)	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Cantaloupe (whole or precut?)	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Honeydew melon (whole or precut?)	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Apples	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Grapes (red or green?)	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns
Strawberries	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> dk/ns

Kiwi ☐ yes ☐ no ☐ dk/ns

Mango ☐ yes ☐ no ☐ dk/ns

Pineapple ☐ yes ☐ no ☐ dk/ns

Avocado ☐ yes ☐ no ☐ dk/ns

Unpasteurized Juices Comments (variety/brand, where bought/eaten, etc.)

Apple juice/cider ☐ yes ☐ no ☐ dk/ns

Orange juice ☐ yes ☐ no ☐ dk/ns

Smoothie ☐ yes ☐ no ☐ dk/ns
specify type/ingredients _____

Other juices ☐ yes ☐ no ☐ dk/ns
specify type/ingredients _____

Cross Contamination/Handling Potential

INDIRECT EXPOSURE TO GROUND MEAT IN THE HOME SETTING

If client answered no to eating some type of ground meat, ask the following.

Was there any ground meat in your refrigerator (not freezer) in the 7 days before your illness?

☐ yes ☐ no ☐ dk/ns If yes, where was meat stored in the refrigerator?

Did you or someone in your household prepare a meal for others that contained ground meat?

☐ yes ☐ no ☐ dk/ns

Did you handle any raw meat/fish at home or anywhere else in the 7 days before your illness?

☐ yes ☐ no ☐ dk/ns

If yes, what kind of meat(s)/fish was it? _____

SECTION 4: RESTAURANTS, GROCERY STORES, EVENTS (Complete for all cases)

Now, I would like to ask you about events in the week before your illness.

Did you eat out at any restaurants (including take-outs, street vendors, home delivery meals) during the week before your illness? ☐ yes ☐ no ☐ don't know/not specified (dk/ns)

Name _____ Date _____ Time: _____
Location _____
Foods eaten: _____

Name _____ Date _____ Time: _____
Location _____
Foods eaten: _____

Name _____ Date _____ Time: _____
Location _____
Foods eaten: _____

Name _____ Date _____ Time: _____
Location _____
Foods eaten: _____

Name _____ Date _____ Time: _____
Location _____
Foods eaten: _____

Where did you purchase groceries that were eaten during the week before your illness (including specialty stores, produce/fruit stands, dairy marts, butcher shop, etc.)?

Name _____
Location _____

Name _____
Location _____

Name _____
Location _____

Name _____
Location _____

Did you attend any large gatherings (parties, festivals, fairs, etc.)? ☐ yes ☐ no ☐ dk/ns
If yes, when ____/____/____ where/type function

Foods eaten

SECTION 5: DRINKING AND RECREATIONAL WATER EXPOSURES (Complete for all cases)

Where does your household water supply come from?

☐ Private well ☐ Municipal/city ☐ Other: (specify)

Is your drinking water treated in any special way (e.g. softened, boiled, filtered)?

☐ yes ☐ no ☐ dk/ns

If yes, check all that apply: ☐ Softened ☐ Boiled ☐ Filtered, type of filter _____

Do you have a cottage or recreational vehicle?

☐ yes ☐ no ☐ dk/ns

If yes, specify the source of your recreational drinking water? _____

Did you drink any bottled water in the last two weeks before your illness?

☐ yes ☐ no ☐ dk/ns

If yes, what brand? _____

Did you drink any untreated water in the last two weeks before your illness (e.g. water from pond, lake, river)?

☐ yes ☐ no ☐ dk/ns

If yes, where _____

Did you drink any water from roadside springs in the last two weeks before your illness?

☐ yes ☐ no ☐ dk/ns

If yes, where _____

Did you do any swimming or wading in the last two weeks before your illness?

☐ yes ☐ no ☐ dk/ns

If yes, what type of swimming area was it? (Check all that apply)

☐ Wading or kiddie pool _____ where _____

☐ Outdoor swimming pool _____ where _____

☐ Indoor swimming pool _____ where _____

☐ Hot tub, jacuzzi or spa _____ where _____

☐ Pond, lake, river or stream _____ where _____

☐ Other (specify) _____ where _____

Did you submerge your head under water? ☐ yes ☐ no ☐ dk/ns

Did you swallow any water? ☐ yes ☐ no ☐ dk/ns

SECTION 6: TRAVEL (Complete for all cases)

Any routine travel (i.e. staying at a cottage) in the last two weeks before your illness? ☐ yes ☐ no ☐ dk/ns

If yes, where? _____

When? From _____ to _____

Any non routine travel in the last two weeks before your illness? ☐ yes ☐ no ☐ dk/ns

If yes, where? _____

When? From _____ to _____

If airline travel, what airline? _____

Outgoing flight no. _____

Return flight no. _____

Foods eaten on plane going there: _____

Return: _____

If you stayed at a resort, please provide resort name:

If cruise ship, name of ship _____

Destinations _____

SECTION 7: FARM AND ANIMAL EXPOSURES (Complete for all cases)

Did you visit a farm or petting zoo at which there were animals? ☐ yes ☐ no ☐ dk/ns

If yes, where _____

What kind of animals were there? _____

Did you have direct contact with any farm animals? ☐ yes ☐ no ☐ dk/ns

If yes, what kind of animal(s)? _____

Where _____

Did you do any gardening? ☐ yes ☐ no ☐ dk/ns

Did you have contact with animal manure (as might occur during farming or gardening)?

☐ yes ☐ no ☐ dk/ns

If yes, what kind of activity were you involved in?

Did you have contact with household pets (including reptiles)? ☐ yes ☐ no ☐ dk/ns

If yes, what kind of animal(s)

Were the animal(s) sick with diarrhea? ☐ yes ☐ no ☐ dk/ns

SECTION 8: OCCUPATION/DAYCARE, HOUSEHOLD & OTHER CONTACT INFORMATION

(Complete for all cases)

Person Interviewed: <input type="checkbox"/> case <input type="checkbox"/> someone else, specify name & relationship to case _____		
Probable Source of Infection _____ <input type="checkbox"/> Unknown		
Environmental Health Officer (EHO) Signature:	Agency:	Date Completed:

GUIDANCE INSTRUCTIONS FOR COMPLETION OF FORM C:

In order to determine the cause of the enteric infection, it is paramount that the following be met:

The form must be completed fully and clearly, and returned as soon as possible to the regional health authority

All details in each appropriate section of this form must be completed. Please note that the form may be sent back for completion by the regional health authority if it is deemed that the information is incomplete

SECTION 1: CLINICAL DATA

Complete for all cases

Any attempted call(s) or visit(s) must be recorded with date(s) & time(s) in the EHO Comment Table located on the bottom of page

SECTION 2: OPEN-ENDED FOOD HISTORY

Detailed length of the food history for this section will depend upon the maximum incubation period of the infectious agent. If infectious agent is unknown, please complete a 3 day food history.

Please photocopy page # 3 if the detailed length of the required food history is greater than three days before illness

SECTION 3: SPECIFIC FOOD ITEMS

Complete this section, if you are unable to obtain a satisfactory detailed food history from Section 2 or directed by the Regional Medical Officer of Health. Please note that a satisfactory detailed food history is defined as obtaining information from at least 50 % or more of the meals for the required length of the food history

SECTION 4: RESTAURANTS, GROCERY STORES, EVENTS

Complete for all cases

SECTION 5: DRINKING AND RECREATIONAL WATER EXPOSURES

Complete for all cases

SECTION 6: TRAVEL

Complete for all cases

SECTION 7: FARM AND ANIMAL EXPOSURES

Complete for all cases

SECTION 8: OCCUPATION/DAYCARE, HOUSEHOLD & OTHER CONTACT INFORMATION

Complete for all cases

SECTION: EHO COMMENTS, ACTIONS & SIGNATURE

Complete for all cases. If interview was completed by an EHO Trainee, the supervising EHO must review & also sign this document.

For waterborne disease cases such as giardiasis where a food history may not be necessary, the requirements are reduced to the completion of sections 1, 4, 5, 6, 7, 8 & . However, Sections 2 or 3 may need to be completed if it is determined during the interview there is a disease link with food.