Shiga Toxin-Producing *Escherichia coli* (STEC) Infection

Manitoba
Public Health Branch

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Abbreviations

CD	Communicable disease
CIDT	Culture-independent diagnostic test
CPL	Cadham Provincial Laboratory
E. coli	*Escherichia coli*
HCP	Health-care provider
HUS	Hemolytic Uremic Syndrome
IP&C	Infection prevention and control
MHSLTC	Manitoba Health, Seniors, and Long-Term Care
MHSU	Manitoba Health Surveillance Unit
MOH	Medical Officer of Health
NAT	Nucleic Acid Test (also known as NAAT- nucleic acid amplification test)
NML	National Microbiology Laboratory
PCH	Personal Care Home
PCR	Polymerase chain reaction
PHAC	Public Health Agency of Canada
PHI	Public Health Inspector
PHIMS	Public Health Information Management System
PHN	Public Health Nurse
STEC	Shiga toxin-producing *E. coli*
Stx	Shiga toxin
VTEC	Verotoxigenic *E. coli*

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Summary of Updates

September 2024

The update of the VTEC (now STEC) Protocol resulted in significant changes from the previous version (2007). The protocol aligns with the updated classification of Shiga toxin-producing *Escherichia coli* (STEC) and has been revised to reflect the current goals and expectations for STEC management.

All sections have been revised, including the following sections below:

- Section 2: The confirmed and probable case definitions have been updated to align with PHAC national case definitions.
- Section 3: Reporting requirements and guidelines for laboratory and healthcare providers have been clarified.
- Section 6: Testing has changed significantly since the previous protocol. Verotoxin assays are no longer used for diagnostic testing of STEC. Information about clearance testing has been emphasized.
- Section 7: Case and contact management has been updated. An emphasis has been placed on identifying cases and contacts who are in high-risk occupations, settings or situations. Exclusion criteria for cases and contacts have been updated.
- Section 9: A new section that provides guidelines for documenting in PHIMS.
- Section 10: A listing of additional resources has been added.
- Section 12: Updated algorithm for STEC outbreak management in a childcare facility. Sample letters have been updated to reflect updated case and contact management guidelines.

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1. Etiology and Background

Escherichia coli (E. coli) is a gram-negative bacterium.

Shiga toxin-producing *E. coli* (STEC) is also referred to as verocytotoxin-producing *E. coli* (VTEC) or enterohemmorrhagic *E. coli* (EHEC). It is a highly virulent pathotype of one of the five known diarrhea-producing *E. coli*. It is comprised of a group of bacteria that express cytotoxins called shiga toxins (Stx 1 and Stx 2), which are also called verocytotoxins or verotoxins. STEC strains that produce Stx 2 are generally more infectious, and more likely to cause severe disease than strains that only produce Stx 1.(1) STEC O157:H7 is the serotype which most commonly contains the Stx 2 and is associated with outbreaks due to its virulence.(2, 3) Other non-O157 serotypes of STEC can also cause illness.

The other four pathotypes of *E. coli* strains which also cause diarrheal illness, but are not shiga toxin-producing are: enterotoxigenic *E. coli* (ETEC), enteropathogenic *E.coli* (EPEC), enteroinvasive *E.coli* (EIEC) and enteroaggregative *E. coli* (EAEC). These strains are not reportable to public health and are not addressed in this protocol.

2. Case Definitions

2.1 Laboratory Confirmed Case

Laboratory confirmation of infection with or without clinical illness:

- Isolation of STEC from an appropriate clinical specimen (e.g., stool, blood, urine);

OR

- Detection of Shiga toxin antigen or nucleic acid in an appropriate clinical specimen (dependent on the test used) using a culture-independent diagnostic test (CIDT), such as a nucleic acid test (NAT), or a polymerase chain reaction (PCR).

Note: Detection of Shiga toxin (e.g. NAT-positive results for the Shiga toxin) is considered a confirmed case, even if unable to isolate *E. coli* (culture negative).

2.2 Probable Case

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

OR

- Detection of *E. coli* O157 nucleic acid that is Shiga toxin negative or pending, with or without clinical illness, in an appropriate clinical specimen (i.e., dependent on the test used), using a NAT, such as a PCR.

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Note: NAT-positive results for ***E. coli* O157** (i.e., the bacteria) that are culture-negative for *E. coli* O157 and Shiga toxin negative or pending would still be considered a probable case.

3. Reporting and Other Requirements

3.1 Laboratory

All positive laboratory results noted in the case definition are reportable by laboratory to the Manitoba Health Surveillance Unit (MHSU) via secure fax or established electronic interface.

Operators of Manitoba clinical laboratories are required to submit positive STEC specimens to Cadham Provincial Laboratory (CPL) within five days of report for further testing.

3.2 Health-Care Providers

For probable cases of STEC infection where a positive lab result is not anticipated (e.g., poor or no specimen taken, person has recovered), health-care providers (HCP) should complete the *Clinical Notification of Reportable Diseases and Conditions form (MHSU-0013)* (found in MHSU's Surveillance Forms webpage) and submit it to Manitoba Health, Seniors and Long-Term Care (MHSLTC) by secure fax.

HCPs should also complete this form to report suspected clusters or outbreaks.

3.3 Reporting Travel Acquired STEC

Regions/jurisdictions are to report laboratory confirmed cases of STEC to MHSU by email that meet one of the following criteria:

1. Two or more laboratory confirmed cases ONLY if cases travelled within 30 days of each other to the same resort, attended the same event or attraction or had another identified common exposure (**note:** if the only common exposure identified is travel to the same country, this should not be reported),

   OR

2. A single laboratory confirmed case ONLY if epidemiologically linked to other unconfirmed illnesses that travelled within 30 days of each other to the same resort, attended the same event or attraction or had another identified common exposure (**note:** if the only common exposure identified is travel to same country, this should not be reported).

MHSU will report the required information to the Public Health Agency of Canada – Outbreak Management Division (PHAC-OMD) by email for further investigation.

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4. Epidemiology

4.1 Reservoir

Cattle are the main reservoir for STEC O157 but also can harbour other non-O157 STEC.(1) Other ruminants including sheep, goats and wild animals (e.g., deer) have been reported to carry these organisms in their intestinal tracts.(4) This is true as well of other mammals such as pigs, horses, rabbits, dogs and cats. Birds such as chickens and turkeys may also be a source of STEC.(3) Contamination can occur during slaughter of these animals, and the process of grinding meat can transfer pathogens from the surface of the meat to the interior.

Fecal contamination of foods such as produce can occur during handling or cultivation. Sources of fecal contamination that can impact surface water or ground water include ineffectual sewage/sanitation systems or run-off from agricultural or urban areas, which in turn can affect drinking water supply systems.(5) STEC has been found for several months in manure and in water sources such as wells, water troughs, ponds, streams and recreational water.

Humans represent a reservoir for person-to-person transmission.

4.2 Transmission

STEC is generally transmitted through the ingestion of contaminated food. Contamination of meat, produce or other food products (e.g., flour, milk, cider) can occur when it comes into contact with feces from domestic or wild animals at some stage during processing and/or preparation. Cultivation practices can also contribute to the contamination of produce (i.e., manure used as fertilizer or irrigation with contaminated water).

Infected produce can result from cross-contamination with meat products during food storage and handling. Improper hand hygiene of infected individuals who prepare or handle food can also be a source of contamination. Use of heat to pasteurize dairy products and fruit juices, as well as cooking meats thoroughly, are methods that assist to kill STEC. A common food source is inadequately cooked ground meat products (e.g., ground beef).(6) Outbreaks have been associated with contaminated foods such as spinach, lettuce, sprouts, melons and unpasteurized milk or apple cider.(1)

Waterborne transmission occurs by ingestion of contaminated drinking water. It can also occur during exposure to contaminated recreational waters (e.g., public beaches, improperly chlorinated swimming pools).

Secondary spread by person-to-person transmission occurs through the fecal-oral route, particularly in families, childcare facilities, personal care homes (PCH) and other residential facilities (e.g., assisted living facilities, group homes).

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Environmental contact is also a potential source, particularly with a carrier animal and its environment (e.g., petting zoos, farms). Illness from exposure to STEC in contaminated environments is most often a result of non-existent or improper hand hygiene.

The infectious dose of STEC is very low.(2)

4.3 Epidemiological Information on *E. coli* Infection

4.3.1 World

Worldwide estimates of *E.* coli can be found in the US Centers for Disease Control and Prevention Travelers' Health website. Some estimates for the US can be found in the CDC's STEC surveillance website.

4.3.2 Canada

Current national epidemiology is available from the Public Health Agency of Canada's Notifiable Disease Charts website and through the National Enteric Surveillance Program's annual summary reports

4.3.3 Manitoba

Provincial and Territorial rates are available through the National Enteric Surveillance Program's annual summary reports.

5. Clinical Presentation and Natural History

The clinical presentation of STEC in humans ranges from asymptomatic infection to non-bloody diarrhea,[1] hemorrhagic colitis (bloody diarrhea), hemolytic uremic syndrome (HUS) and death.(2) After ingestion of the organism, the bacteria colonize the intestine and secrete cytotoxin(s), which can act locally or systemically.(7) Disease with STEC typically begins with abdominal cramps and non-bloody diarrhea that can progress to bloody diarrhea, nausea, vomiting, headache and fever. Symptomatic disease is usually self-limiting.(2)

STEC infections can occur in individuals of all ages. Children aged one to four are most frequently diagnosed with STEC infection and are at highest risk of developing HUS. Older adults are at highest risk of death from HUS.(1)

[1] Diarrhea is defined as three or more watery/unformed stools in a 24-hr period, or more frequent stools than is normal for the individual. (see Shared Health's document)

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HUS is a severe manifestation of STEC infection characterized by a combination of renal failure, low platelet count and hemolytic anemia. STEC is the primary cause of HUS following a diarrheal illness. STEC O157:H7 strains, particularly those producing Stx 2, are associated with HUS. Approximately six per cent of lab-confirmed *E. coli* O157 cases of all ages and 15 percent of lab-confirmed *E. coli* O157 cases under five years of age progress to HUS. HUS can cause neurological complications such as seizure, stroke and coma. Complications are most common in children under five years of age and the elderly. The case fatality rate for children with HUS is approximately three to five per cent.(2)

5.1 Incubation Period

The incubation period of STEC ranges from one to 10 days, typically three to four days after the exposure. HUS, if occurs, develops an average of seven days after the first symptoms, when the diarrhea is improving.

5.2 Period of Communicability

In humans, *E. coli* may be shed in the stool for several weeks following resolution of symptoms. In adults, fecal shedding of *E. coli* typically lasts one week or less. Young children tend to carry the organism longer than older children and adults. Fecal shedding can last for three weeks in one-third of children. Asymptomatic prolonged carriage is unusual.

6. Testing and Diagnosis

6.1 Laboratory Tests

The CPL *General Requisition* form for STEC laboratory testing is available online. HCPs should select 'Culture & Sensitivity (C&S)' and can specifically request "free fecal Shiga toxin" for follow-up testing as required (see Section 6.2) in the 'Other Tests or Requests' section. Stool specimens should be submitted to CPL as per CPL Guide to Services.

Stx gene expression results in the synthesis of Shiga toxin, which is the main virulence factor of STEC. STEC laboratory testing includes NAT for the presence of genes encoding Shiga toxin (Stx genes), and free fecal Shiga toxin to determine if Shiga toxin is being produced. NAT may be positive beyond an individual's infectious period due to late shedding of genetic material. The laboratory testing process is described in more detail in the following paragraph.

All stool specimens submitted for bacterial testing undergo a NAT that detects nucleic acids for Shiga toxin-producing organisms, *Campylobacter* spp., *Shigella* spp. and *Salmonella* spp. Shiga toxin-producing organisms are most likely *E. coli*, but also include *Shigella dysenteriae* and other Enterobacterales. Samples that have a positive NAT for Shiga toxin-producing organisms are cultured to attempt to recover the STEC isolate, and tested for free fecal Shiga toxin, previously known as free fecal verotoxin, using an enzyme immunoassay.

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If the STEC isolate is recovered on culture, traditional serotyping is performed by the National Microbiology Lab (NML), and whole genome sequencing is performed by CPL to confirm O157 serotypes and classify non-O157 serotypes. Whole genome or partial sequencing investigations conducted by CPL or NML may identify possible clusters of activity. This may then generate further investigation, such as for additional possible exposures and outbreaks.

Note: If more than one target is positive on the gastrointestinal NAT panel, it may be indicative of a cross-reaction, co-infection and/or a single organism harbouring these genes. Reflex culture should be performed to confirm all suspect bacterial NAT signals and to meet requirements for epidemiologic, public health and clinical management of that organism.

6.2 Testing Cases for Clearance

HCPs requesting stool samples as follow-up for clearance should include an adequate history on the requisition form and a specific request for free fecal Shiga toxin in the 'Other Tests or Requests' section. For clearance testing, only free fecal Shiga toxin testing is necessary. Other testing, including NAT, is not necessary and will not be performed by CPL for clearance testing. NAT testing of stool from a previously known Shiga toxin NAT-positive person may demonstrate late shedding of detectable genetic material and should not be used to determine if the person is infectious.

7. Control

7.1 Management of Cases

This section is applicable for both confirmed and probable STEC cases. All cases should be instructed about disease transmission and appropriate personal hygiene. Routine practices are indicated for cases during acute illness. Contact precautions are recommended when caring for adults and children who are incontinent, stool cannot be contained, or have poor hygiene and may contaminate the environment.

Anyone with diarrheal symptoms should avoid the following:

- handling or preparing food for others;
- providing direct care to individuals who may be at higher risk of severe infection from STEC, such as adults aged 60 or older, immunocompromised individuals and children under five years of age(6);
- Swimming in lakes or recreational waters (e.g., pools, hot tubs) or sharing a bath with others.(1)

Cases in a *high-risk occupation*[2] or in a *high-risk setting or situation*[3] should be identified as this may inform their period of exclusion.

[2] High-risk occupations are occupations where workers may pose a higher risk of STEC transmission to others. High-risk occupations include food handlers, child care workers and healthcare workers.

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7.1.1 Exclusion Criteria for Cases

7.1.1.1 Cases in a High-Risk Occupation

For cases working in a high-risk occupation, factors that should be taken into consideration include the nature of duties of the case, the rigor of infection prevention and control (IP&C) measures in the high-risk setting, the symptoms of the case and the level of personal hygiene of the case (i.e., those with poor hygiene who may contaminate the environment).

Cases working in a high-risk occupation should be excluded from handling food or providing patient or childcare until two stool specimens test negative for free Shiga toxin. The stool specimens should be collected at least 24 hours apart AND 48 hrs after diarrhea has stopped. A case may attend work prior to obtaining two negative stool specimens only if symptoms have resolved and they can be assigned to duties that do not involve handling food or providing direct care to others until test results are negative. A Medical Officer of Health (MOH) may also exercise their discretion to allow a return to work without obtaining two negative stool specimens if symptoms have resolved and hygiene is adequate. An exclusion letter and a return-to-work letter may be required for public health to provide to the employer. Health care workers should check for return-to-work requirements with occupational health or designate.

7.1.1.2 Cases in a High-Risk Setting or Situation

For cases in a high risk setting or situation, factors that need to be taken into consideration are the case's age, toileting abilities (including whether diapers are used, stool is contained, and the degree of assistance required with toileting and hygiene), symptoms, activities and level of personal hygiene

Cases in a high risk setting or situation should be excluded from the high risk setting or situation until two follow-up stool specimens test negative for free fecal Shiga toxin. The stool specimens should be collected at least 24 hours apart and 48 hours after diarrhea has stopped. An MOH may exercise their discretion to allow return to a high-risk setting (such as a school or childcare facility) without obtaining two negative stool specimens if symptoms have resolved for 48 hours, hygiene is adequate (i.e., unlikely to contaminate the environment), and the case can toilet independently. For those that are residents in a PCH or patients in an acute care facility, IP&C should be notified.

[3] High-risk settings or situations are those where cases may pose a high-risk of STEC transmission to others. High-risk settings include child care facilities and long-term care facilities (e.g., PCHs). High-risk situations include situations where cases are diapered or unable to maintain adequate personal hygiene.

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7.1.1.3 Other Cases

Routine exclusion of cases who are not working in high-risk occupations or in high-risk settings or situations is generally not indicated. However, cases should be advised to remain home from work or school until 48 hours after diarrhea has stopped.

Table 1 – Summary of Case Exclusion Requirements

Status	Cases in a High-Risk Occupation or High-Risk Setting or Situation		Other Cases	
	Symptomatic	Asymptomatic	Symptomatic	Asymptomatic
Exclusion	Exclude until diarrhea has stopped for at least 48 hours and 2 negative results for free Shiga toxin	Exclude until 2 negative results for free Shiga toxin	No exclusion Advise to self-exclude from work or school until 48 hrs after diarrhea has stopped.	No exclusion
Stool Specimen(s) Required to End Exclusion	2 specimens: 24 hrs apart AND at least 48 hrs after diarrhea has stopped.	2 specimens: 24 hrs apart	None	None

7.1.2 Treatment for Cases

Treatment for STEC is supportive. No specific treatment has been shown to decrease the severity of illness or prevent complications. There is no evidence demonstrating that antimicrobial therapy is beneficial, and there is evidence that it may be harmful; therefore, it is not recommended. Antimotility agents should not be administered. Maintenance of hydration, electrolyte balance and nutrition is crucial.

For cases who develop severe complications, such as HUS, treatment may involve hospitalization and other interventions such as blood transfusions or kidney dialysis.

7.2 Management of Contacts

Contact Definition:

- household members, sexual contacts, or other persons who have had close contact with the case (i.e., travelling together, patients/residents that share a room)
- those who attend or work in the same child care facility as the case
- individuals exposed to the same source
- individuals who have shared food or eaten food prepared by the case during the case's communicability period

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Individuals who are identified as contacts should be assessed for symptoms to determine if they meet the criteria for a probable case. Individuals who meet the probable case definition should be managed as a case (see Section 7.1).

Contacts of a STEC case should be managed as follows:

- Contacts should be instructed about disease transmission and appropriate hygiene. Routine practices and contact precautions are indicated for contacts during acute illness.
- Anyone with diarrheal symptoms should avoid the following:
    - handling or preparing food for others;
    - providing direct care to individuals who may be at higher risk of severe infection from STEC, such as adults aged 60 or older, immunocompromised individuals and children under five years of age (6);
    - swimming in lakes or recreational waters (e.g., pools, hot tubs) or sharing a bath with others.(1)

All contacts (symptomatic and asymptomatic) in a *high-risk occupation*[4] or in a *high-risk setting or situation*[5] should be identified.

7.2.1 Exclusion Criteria for Contacts

7.2.1.1 Symptomatic Contacts in a High-Risk Occupation, Setting or Situation

Symptomatic contacts in a high-risk occupation, setting or situation should be assessed by a health care provider and two stool specimens collected 24 hours apart should be obtained for testing. Symptomatic contacts should be managed as a probable case until test results are available. If positive, manage as a case; if negative, allow back to work or to childcare facility 48 hours after diarrhea has resolved. (see Section 7.1.1).

Note: A contact may attend work prior to obtaining two negative stool specimens only if symptoms have resolved and they can be assigned to duties that do not involve handling food or providing direct care to others. An MOH may also exercise their discretion to allow a return to work or return to a high-risk setting or situation, without obtaining two negative stool specimens if symptoms have resolved for 48 hours, hygiene is adequate (i.e., unlikely to contaminate the environment), and the case can toilet independently. For contacts who attend or work in a childcare facility refer to Section 7.4.2.

[4] *High-risk occupations* are occupations where workers may pose a higher risk of STEC transmission to others. High-risk occupations include food handlers, child care workers and health-care workers.

[5] *High-risk settings or situations* are those where cases may pose a high-risk of STEC transmission to others. High-risk settings include child care facilities and long-term care facilities (e.g., PCHs). High-risk situations include situations where cases are diapered or unable to maintain adequate personal hygiene.

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7.2.1.2 Asymptomatic Contacts in a High-Risk Occupation

Asymptomatic contacts in high-risk occupations generally do not require testing or exclusion.

7.2.1.3 Asymptomatic Contacts in a High-Risk Setting or Situation

For asymptomatic household or other close contacts to a case not associated with a childcare facility, but where the asymptomatic contact attends a childcare facility, exclude until one negative stool sample for free Shiga toxin is obtained. (**Note:** For attendees in childcare facilities with one or more probable or confirmed cases in the childcare facility, contacts will be managed as per Section 7.4.2.)

Asymptomatic contacts who attend other high-risk settings or situations may be excluded until one negative stool sample for free Shiga toxin is obtained. Factors that should be considered are the activities of the contact, the setting and the personal hygiene of the contact.

7.2.1.4 Other Contacts

Routine testing and exclusion is not indicated for asymptomatic contacts who are not in high-risk occupations, settings or situations. Symptomatic contacts should be managed as a probable case and referred to their health care provider for assessment and testing.

For outbreak situations, refer to Section 7.4.

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Table 2 – Summary of Contact Exclusion Requirements				
Status	Contacts in a High-Risk Occupation or High-Risk Setting or Situation		Other Contacts	
	Symptomatic	Asymptomatic	Symptomatic	Asymptomatic
Exclusion	Exclude until 2 negative results for free Shiga toxin and 48 hours after diarrhea has stopped If positive, manage as a case	If a household or close contact and attends a childcare facility where no other cases identified (Note: see section 7.4 for management of a childcare facility where there is one or more confirmed or probable STEC case(s)) OR if in other high-risk settings and exclusion is required based on MOH discretion: exclude until 1 negative result for free Shiga toxin	No exclusion Advise to self-exclude from work or school until 48 hrs after diarrhea has stopped	No exclusion
Stool Specimen(s) Required to End Exclusion	2 specimens: 24 hrs apart	1 specimen	None	None

7.3 Preventive Measures

All cases and contacts should be educated on the following STEC prevention strategies:

- Discuss personal hygiene practices regarding hand hygiene after changing diapers, using sanitary facilities and after sexual activity, as well as risk of sexual practices that involve fecal-oral contact.
- Education about sanitation in diaper changing areas in homes and childcare facilities; encourage frequent hand hygiene.
- Hand hygiene should be performed by washing hands thoroughly with soap and water (for a minimum of 15 seconds) or using alcohol-based hand sanitizer before preparing and eating food, especially after handling raw meat products.
- Education about cross contamination of food preparation environments (kitchen counters, sinks, cutting boards) and implements (meat cutting and grinding, utensils, dish cloths, etc.).

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- Education in principles of good hygienic practice, to keep contamination to a minimum while butchering and processing animal products.
- Thorough cooking of all food derived from animal sources. Cook ground beef until no pink meat remains, juices are clear, and to an internal temperature of 71°C. Refer to Health Canada – Safe Cooking Temperatures.
- Wash produce (e.g., fruits and vegetables) thoroughly, prior to consumption.
- Avoid consumption of unpasteurized milk, juices, ciders and raw sprouts, especially by those most susceptible to severe complications (e.g., young children, elderly, pregnant and those with compromised immune systems).(1)
- Drinking water should be chlorinated or boiled if safety of water is unknown. Testing and treatment of private water sources if water quality is unknown or contamination is suspected. Avoid ingestion of recreational water.
- Perform hand hygiene by washing hands thoroughly with soap and water (for a minimum of 15 seconds) or using alcohol-based hand sanitizer after contact with farm animals or animals at petting zoos and their environment.

7.4 Cluster and Outbreak Management

7.4.1 Health-care Facilities

Health-care facilities (e.g., acute care and long-term care) should develop and follow established outbreak management protocols for enteric infections.

7.4.2 Childcare Facilities

Childcare facilities (including home daycares), provide care for infants, toddlers and preschool age children.

7.4.2.1 One Probable or Confirmed STEC Case

In a childcare facility where there is one confirmed or probable STEC case regardless of age who attended the facility within 10 days before or any time after the onset of diarrhea:

- Public health to contact childcare facility to determine if any other children or staff in the 10 days before or anytime after the case's onset of diarrhea have or had symptoms of diarrhea or are known contacts of other cases.

- If no other children or staff have been symptomatic or known to be contacts of other cases, a letter providing general information on STEC, its transmission and guidance on what to do if a child develops symptoms suggestive of STEC infection should be sent to all families. A sample letter (see Section 12.2) is provided as an example.

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- If any other children or staff have or had diarrheal symptoms, manage as a probable case. Two stool specimens collected 24 hours apart should be obtained for testing. If positive, manage as a case; if negative, allow back to the childcare facility 48 hours after diarrhea has resolved. If there is one case and any number of symptomatic contacts in the childcare facility, initiate an outbreak investigation and consider closing the facility until test results are known (see Section 7.4.2.2).

7.4.2.2 Two or More Probable or Confirmed STEC Cases

Two or more probable or confirmed STEC cases who attended the facility within 10 days before or any time after onset of diarrhea is suggestive of an STEC outbreak. When an outbreak of STEC occurs in a childcare facility, the following actions should be taken:

- The MOH or designate should meet with the childcare administration to review the cases and discuss control measures. The Public Health Inspector (PHI) should also be notified and will work in collaboration with public health.
- All children, regardless of symptom status, and all symptomatic staff should be excluded from attending the childcare setting. Two stool specimens collected 24 hours apart should be obtained from all children and staff regardless of symptom status, who attended the childcare facility during the time period, beginning four weeks before onset of diarrhea in the index child and up to the initiation of the outbreak investigation. Stool collection should be coordinated by the local public health jurisdiction, with assistance from the provincial laboratory as required (i.e., assignment of an outbreak code).
    - Children with positive stool specimens should continue to be excluded, even if asymptomatic, until two specimens negative for free fecal Shiga toxin and until all other criteria for re-entry set out by the MOH and/or designate are met. Stool samples should be taken at least 24 hours apart and 48 hours after symptoms have resolved. Parents should be advised not to take their children to another childcare facility.
    - Children with negative stool specimens who are symptomatic should not re-enter the childcare facility until 48 hours after symptom resolution, and all other criteria for re-entry set out by the MOH and/or designate are met.
    - Children with negative stool specimens who are asymptomatic may re-enter if all other criteria for re-entry set out by the MOH and/or designate are met.
    - Children who are unable to be tested should be excluded until 48 hours after symptom resolution or 10 days after the last exposure to case, whichever is longer, and until all other criteria for re-entry set out by the MOH and/or designate are met.
    - For childcare staff who have symptoms or a positive stool specimen, refer to Section 7.1.1.1.
    - Asymptomatic staff may attend the facility before stool specimen results are available provided that appropriate hygiene measures are met. If symptoms develop and/or test results are positive, exclude immediately and manage as per Section 7.1.1.1.

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- Outbreaks often involve a coordinated outbreak response team, which may include MOHs, epidemiologists, PHNs, PHIs, CD Coordinators and others. The MOH assumes the lead role for the assessment, decision-making and response in an outbreak investigation. Site inspections of implicated facilities are conducted by PHIs. The MOH in collaboration with the PHI may seek to close the facility until any public health violations identified during the inspection have been addressed and amended. Facility closure can provide an opportunity for thorough environmental cleaning.
- The local public health jurisdiction should collect and analyze data from the outbreak investigation. The MOH and/or designate (CD Coordinator or PHN) should review clinical and stool test reports. The MOH will work in consultation with the outbreak response team to make decisions around childcare facility closure and reopening. The MOH and/or designate will determine when the outbreak is over. Generally, an outbreak is considered over if no cases are identified for two incubation periods.
- A letter providing general information on STEC transmission and specific instructions regarding stool collection procedures and criteria for re-entry into childcare should be sent to all families when the investigation is initiated. A sample letter (see Section 12.3) is provided as an example.

Refer to Section 12.1 Appendix A: Algorithm for STEC Outbreak Management in a Childcare Facility.

7.4.3 Other Community Outbreaks

For further guidance and resources for outbreak management of STEC or suspected STEC, refer to the MHSLTC Enteric Illness Protocol.

8. Key Investigation Components for Public Health Response

Key Components of the Case Investigation

- Obtain a history of illness including the date of onset, and signs and symptoms.
- Complete a food recall history using the *Shiga toxin-producing E.coli (STEC) Food Recall Questionnaire (MHSU-3265)* (found in MHSU's Surveillance Forms webpage) and explore other potential sources of exposure such as visiting a farm or petting zoo, swimming or playing at a water park or wading pool, occupational exposure (e.g., animal or meat handling), high risk sexual practices, contact to a known case or someone with a similar illness, or travel.
- Identify cases that work in high-risk occupations (e.g., food handler, health-care worker, childcare provider) or attend or live in high-risk congregate settings (e.g., childcare facility, personal care home). Refer to management of cases for exclusion and testing requirements. Assess for symptoms and provide education regarding risk and prevention of secondary transmission. Provide education on preventive measures (see section 7.3).
- Identify all close contacts.
- Assess for history of similar symptoms in other members of the household or other contacts, especially contacts in sensitive environments.

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- Report cases as required to the local PHI. The PHI may conduct microbiologic analysis of food and water samples that were ingested if history implicates food or drinking water as the source of illness and/or multiple cases report eating a common food item or eating at a common food establishment.
- Initiate outbreak response if investigation suggests evidence of transmission to others.

Key Components of the Contact Investigation

- Follow-up all contacts for risk of exposure.
- Identify symptomatic contacts and manage as probable cases.
- Identify contacts that work in high-risk occupations (e.g., food handler, health-care worker, childcare provider) or attend or live in high-risk settings (e.g., childcare facility, personal care home). Refer to management of contacts for exclusion and testing requirements (see Section 7.2).
- Assess for symptoms and provide education regarding risk and prevention of secondary transmission. Refer to management of contacts for further guidance (see Section 7.2).
- Provide education on preventive measures (see section 7.3).

9. Documentation Guidelines and Resources

All case investigations are to be completed in the Public Health Information Management System (PHIMS). For public health providers without access to PHIMS, the *Communicable Disease Control Investigation Form (MHSU-0002)* and the *Shiga toxin-producing E.coli (STEC) Food Recall Questionnaire (MHSU-3265)* (both found in MHSU's Surveillance Forms webpage) should be completed and submitted to MHSLTC by secure fax. The critical data elements which are required documentation for all case and contact investigation are listed with an asterisk (*) on the investigation forms.

PHIMS Quick Reference and User Guides are available at the PHIMS website.

Refer to the Regional Management of Outbreaks in PHIMS (Standard Operating Procedures (SOP)) for guidance on documenting outbreaks in PHIMS. All case/contact investigations within a transmission chain should be linked to the outbreak.

The following information in Table 3 and Table 4 is intended to provide broad regional public health guidance and timelines for the majority of STEC case and contact investigations.

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Table 3 – Timelines for Documenting STEC Cases in PHIMS

Investigation Component	PHIMS Data Entry/Public Health Response	Timeline from PH Report Date†
Region/jurisdiction receives new case investigation from MHSLTC SU Responsible Org and Workgroup assigned by MHSLTC SU OR *Report of new investigation outside of PHIMS (e.g., report from a care provider of a diagnostic that did not go through CPL and MHSU)	• Create investigation if not created (i.e. probable case reported to region) • Assign Primary Investigator or CD Coordinator and review investigation and lab results. • Contact provider and initiate case and contact investigation. • Update "Disposition" from" Pending" (e.g., Follow up in Progress). • Contact case directly and proceed with case investigation.	1 day
Data entry: Document case details in PHIMS	• Complete and update PHIMS data as soon as possible, including on weekends. • Update "Classification" based on case definition and classification date. • The completed STEC Food Recall Questionnaire is to be uploaded as a context document along with a note indicating the document has been added. • For severe cases (e.g., HUS), document under "Outcome" and choose "Other" and document HUS as soon as confirmed. • Enter all symptomatic and asymptomatic close contacts (identified either by testing practitioner or contact with client). Ensure a risk assessment and documentation is completed. (e.g., sensitive occupations, testing and exclusion requirements, education). Contacts that meet the criteria of a probable case are to be created as their own case in PHIMS and followed up as same.	1¬3 days
Close investigation	• Update Disposition: Follow up Complete OR Lost to Follow up, OR Unable to Locate. • Investigation Status: Closed.	3¬4 weeks
Quality Assurance	• Each region employs a Quality Assurance process to ensure the following minimum data requirements have been entered: Classification, Signs and Symptoms, Risk Factors, Acquisition Events and Context Document(s)	1 week post investigation closure

†Days refer to working days

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Table 4 – Timelines for Documenting STEC Contacts in PHIMS		
Investigation Component	PHIMS Data Entry/Public Health Response	Timeline from PH Report Date†
Region/jurisdiction receives or creates a new contact investigation	• Assign Primary Investigator, Responsible Organization, and Workgroup. • Update Disposition from Pending (e.g., Follow up in Progress). • Primary investigator attempts to locate and contact client for notification of exposure.	1 day
Data entry: Document contact details in PHIMs	• Complete and update PHIMS data as soon as possible, including on weekends. • Contacts that meet the criteria of a probable case are to be created as their own case in PHIMS and followed up as same. • Ensure a risk assessment and documentation is completed. (e.g., sensitive occupations, testing and exclusion requirements, education). • Document all interventions (i.e,. exclusions, referral to health care provider for testing). • If contact tests positive, update "Disposition" to "Contact turned Case" and close contact investigation. Further documentation to be completed in the case investigation. • If unable to locate contact or client unreceptive to follow-up, hold open for 21 days with regular attempts to locate contact or reconnect with contact's health care provider.	1¬3 days
Close investigation	• Update Disposition: Follow up Complete OR Lost to Follow up, OR Unable to Locate. • Contacts from high-risk occupations or high-risk settings that require testing, should remain open until required testing is completed and exclusion requirements have been met. • Other contacts can be closed after education has been provided. Education and general guidance may be completed directly with the contact or via the case (e.g., household contacts)	3¬4 weeks
Quality Assurance	• CD Coordinator review by Quality Assurance Report level for minimum data elements only	As per regional/jurisdictional routine requirements

†Days refer to working days

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10. Additional Resources

Cadham Provincial Laboratory
Requisition Form
https://healthproviders.sharedhealthmb.ca/files/general-requisition-form.pdf
Guide to Services 2020
https://healthproviders.sharedhealthmb.ca/files/guide-to-services.pdf

Government of Canada
E-coli (Escherichia coli) Infection
www.canada.ca/en/public-health/services/diseases/e-coli.html
General Food Safety Tips
www.canada.ca/en/health-canada/services/general-food-safety-tips.html
Public Health Agency of Canada
enteric.outbreak-eclosion.enterique@phac-aspc.gc.ca

Manitoba Health, Seniors and Long-Term Care
Enteric Illness Protocol
https://www.gov.mb.ca/health/publichealth/cdc/protocol/enteric.html
Public Health Inspector Contact Form
https://forms.gov.mb.ca/cmphi/
Surveillance Unit
Secure fax: 204-948-3044
Email: PHSurveillenceMB@gov.mb.ca

Shared Health
IP&C Definitions
https://healthproviders.sharedhealthmb.ca/files/ipc-definitions.pdf

US Centers for Disease Control and Prevention (CDC)
E-coli (Escherichia coli) Infection
https://www.cdc.gov/ecoli/index.html
Travel-Associated Infections & Diseases—Escherichia coli, Diarrheagenic
https://wwwnc.cdc.gov/travel/yellowbook/2024/infections-diseases/escherichia-coli-diarrheagenic

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11. References

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3. E. coli. Geneva, CH: World Health Organization; 2018 [updated February 7, 2018; cited 2023 November 22]; Available from: https://www.who.int/news-room/fact-sheets/detail/e-coli.

4. Holtz LR, Tarr PI, Kaplan SL. Shiga toxin-producing Escherichia coli: Microbiology, pathogenesis, epidemiology, and prevention. Philadelphia: Wolters Kluwer; 2023 [updated August 3, 2023; cited 2023 November 22]; Available from: https://www.uptodate.com/contents/shiga-toxin-producing-escherichia-coli-microbiology-pathogenesis-epidemiology-and-prevention?search=stec&topicRef=2714&source=see_link.

5. E. coli Guideline Technical Document. Ottawa: Health Canada; 2020 [cited 2024 March 13]; Available from: https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-escherichia-coli.html#p2.

6. Risks of E. coli (Escherichia coli) infection. Ottawa: Public Health Agency of Canada; 2017 [updated April 3, 2017; cited 2023 December 19]; Available from: https://www.canada.ca/en/public-health/services/diseases/e-coli/risks-e-coli.html.

7. Hunt JM. Shiga toxin–producing Escherichia coli (STEC). Clinics in laboratory medicine. 2010;30(1):21-45.

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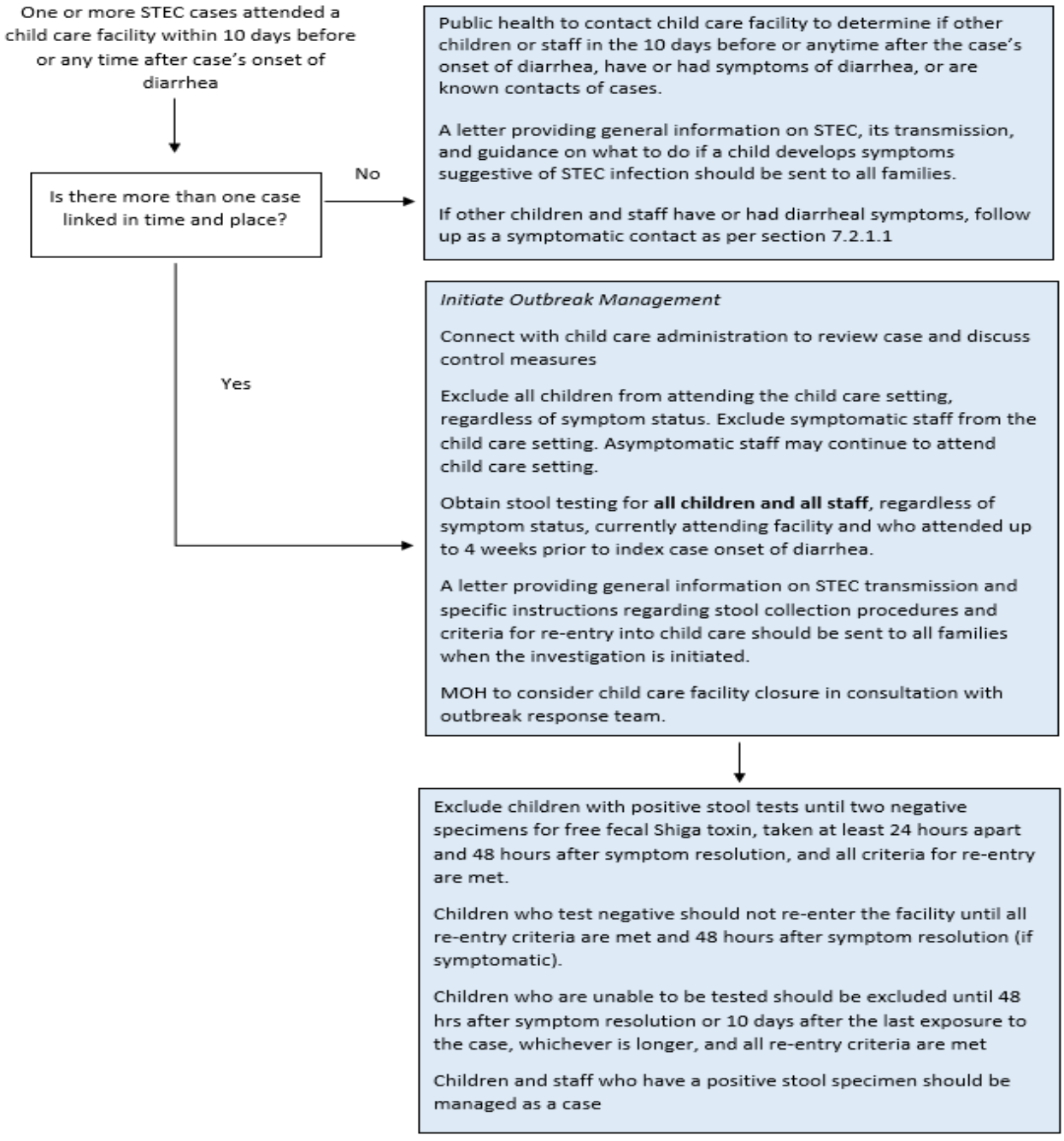
12. Appendices

12.1 Appendix A: STEC Outbreak Management in a Childcare Facility



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12.2 Appendix B: Sample letter notification for parents/guardians after one case has been identified in a childcare facility

Dear Parent or Guardian:

Public Health is investigating a case of diarrhea caused by Shiga toxin-producing *E.coli* bacteria (STEC) that attended the < *name of childcare facility and location*>.

STEC infection is commonly caused by eating food or drinking water contaminated with the bacteria (e.g., ground beef, unpasteurized milk) or exposure to feces (poop) of infected animals. STEC symptoms often includes watery diarrhea, vomiting and stomach cramps. In severe cases, diarrhea may become bloody, and a high fever can develop. In some children, a more severe illness known as HUS (hemolytic uremic syndrome) may occur. This illness affects the kidneys and requires hospitalization. Most children do not develop HUS and recover completely from their diarrhea. If your child develops any of the above symptoms you should see a health care provider.

Person-to-person spread of STEC infection can occur among children attending childcare facilities. Contamination of their hands with stool allows the bacteria to spread when children handle toys and play together. Careful hand washing with soap and water for a minimum of 15 seconds can help to prevent the bacteria from spreading and is important for children and caregivers to do:

- After toileting or diaper changes
- Before food preparation or eating.

Please contact your health care provider and your local public health office at *XXX-XXXX* if:

- your child develops diarrhea during the next two weeks OR
- has been ill with diarrhea in the past four weeks.

For further information on STEC infection refer to:
https://www.gov.mb.ca/health/publichealth/diseases/ecoli.html

Yours sincerely,

Medical Officer of Health

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12.3 Appendix C: Sample letter notification for parents/guardians after an outbreak has been identified in a childcare facility

Dear Parent or Guardian:

Public health is investigating the occurrence of several cases of diarrhea in the < *name of childcare facility and location*> caused by a type of bacteria known as Shiga toxin-producing *E. coli* (STEC).

STEC infection is commonly caused by eating food or drinking water contaminated with the bacteria (e.g., ground beef, unpasteurized milk) or exposure to feces (poop) of infected animals. STEC symptoms often includes watery diarrhea, vomiting and stomach cramps. In severe cases, diarrhea may become bloody, and a high fever can develop. In some children, a more severe illness known as HUS (hemolytic uremic syndrome) may occur. This illness affects the kidneys and requires hospitalization. Most children do not develop HUS and recover completely from their diarrhea. If your child develops any of the above symptoms you should see a health care provider.

Person-to-person spread of STEC infection can occur among children attending childcare facilities. Contamination of their hands with stool allows the bacteria to spread when children handle toys and play together. Careful hand washing with soap and water for a minimum of 15 seconds can help to prevent the bacteria from spreading and is important for children and caregivers to do:

- After toileting or diaper changes
- Before food preparation or eating.

Since children are more likely to develop severe symptoms, it is important to determine if the infection is being spread in the childcare facility. Public health nurses will ask you a series of questions about diarrhea in your family and will organize the collection of stool specimens from each child.

To prevent the spread of infection, your child cannot attend the childcare facility or attend another childcare facility until they are tested and the following criteria are met:

- **If your child has a positive stool sample**: They cannot return to the childcare facility or enter any other childcare facility until diarrhea has stopped for 48 hrs AND have two negative stool samples. Repeat testing after symptoms resolve helps to determine if your child is still infectious.

- **If your child has 2 negative stool samples**: They can return to the childcare facility or enter another childcare facility if they have not had diarrhea or until diarrhea has stopped for 48 hours.

Please do not hesitate to contact us if you have any questions.

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Public Health Nurse: _____Phone: _____

For further information on STEC infection refer to:
https://www.gov.mb.ca/health/publichealth/diseases/ecoli.html

Yours sincerely,

Medical Officer of Health