

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

Infectious Disease Protocol

# Appendix 1: Case Definitions and Disease- Specific Information

**Disease: Verotoxin-producing  
*E. coli* infection indicator  
conditions, including Hemolytic  
Uremic Syndrome (HUS)**

Effective: May 2022

# Verotoxin-producing *E. coli* infection indicator conditions, including Hemolytic Uremic Syndrome (HUS)

Communicable

Virulent

[Health Protection and Promotion Act \(HPPA\)](#)

[Ontario Regulation \(O. Reg.\) 135/18 \(Designation of Diseases\)](#)

## Provincial Reporting Requirements

Confirmed case

Probable case

As per Requirement #3 of the "Reporting of Infectious Diseases" section of the *Infectious Diseases Protocol, 2018* (or as current), the minimum data elements to be reported for each case are specified in the following:

- [O. Reg. 569](#) (Reports) under the HPPA;<sup>5</sup>
- The [iPHIS User Guides](#) published by Public Health Ontario (PHO); and
- Bulletins and directives issued by PHO.

## Type of Surveillance

Case-by-case

## Case Definition

### Confirmed Case

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

- Isolation of verotoxin-producing *Escherichia coli* (VTEC) by culture from an appropriate clinical specimen (e.g., stool, urine, blood)

### Probable Case

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

#### OR

- Hemolytic uremic syndrome (HUS) diagnosed by a physician and not caused by defects in serum complement, chemotherapy, immunosuppressant drugs, pregnancy, oral contraceptives, or known infections other than *Escherichia coli* (*E. coli*) VTEC

#### OR

- Positive/detection of verotoxin/shigatoxin by antigen test (e.g., Enzyme Immunoassay (EIA)) or nucleic acid amplification test (NAAT)

### Outbreak Case Definition

The outbreak case definition varies with the outbreak under investigation. Please refer to the *Infectious Diseases Protocol, 2018* (or as current) for guidance in developing an outbreak case definition as needed.

The outbreak case definitions are established to reflect the disease and circumstances of the outbreak under investigation. The outbreak case definitions should be developed for each individual outbreak based on its characteristics, reviewed during the course of the outbreak, and modified, if necessary, to ensure that the majority of cases are captured by the definition. The case definitions should be created in consideration of the outbreak definitions.

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

## Clinical Information

### Clinical Evidence

Clinically compatible signs and symptoms are characterized by diarrhea (often bloody) and abdominal cramps. Fever is often absent. Illness may be complicated by HUS, thrombocytopenia purpura (TTP) or pulmonary edema. Asymptomatic infections may also occur and the organism may cause extra-intestinal infections.

Clinical evidence of HUS includes: uremia, thrombocytopenia, acute renal failure and central nervous system signs and symptoms. A diarrheal prodrome usually occurs in 86- 95% of patients and of those with diarrhea, 60-75% of the diarrhea is bloody.

### Clinical Presentation

Self-limiting enteric disease in infants and adults; characterized by bloody or non-bloody diarrhea and severe abdominal pain or cramping. Fever is not present in most cases and symptoms usually last fewer than five days.<sup>3,4</sup>

Most individuals recover without residual sequelae, however, complications such as hemorrhagic colitis and hemolytic uremic syndrome (HUS) can occur. HUS occurs in about 15% of infected children as well as in a small number of adults, particularly the elderly.<sup>1,3</sup>

## Laboratory Evidence

### Laboratory Confirmation

Any of the following will constitute a confirmed case of verotoxigenic *E. coli* infection:

- Positive VTEC culture

### Approved/Validated Tests

- Standard culture for VTEC including serotyping

- Enzyme Immunoassay (EIA) for the detection of verotoxin/shigatoxin
- NAAT (which includes polymerase chain reaction (PCR) and multiplex molecular tests) for the detection of genes encoding verotoxin/ shigatoxin

## Indications and Limitations

- Sorbitol MacConkey agar is reliable for detecting most isolates of VTEC serotype O157:H7 and O157:H- because these serovars are sorbitol-negative. It is not reliable for detecting other VTEC serotypes.
- Routine screening for non-O157 VTEC is not routinely performed in most laboratories. This testing can be performed at the Public Health Ontario Laboratories if specifically requested.
- Serotyping is indicated to ensure identification of *E. coli* O157:H7 as well as non-O157 serotypes that are associated with serious disease especially serogroups O26, O45, O103, O111, O121 and O145.
- Further strain characterization is indicated for public health purposes.

For further information about human diagnostic testing, contact the [Public Health Ontario Laboratories](#).

## Case Management

In addition to the requirements set out in the Requirement #2 of the "Management of Infectious Diseases – Sporadic Cases" and "Investigation and Management of Infectious Diseases Outbreaks" sections of the *Infectious Diseases Protocol, 2018* (or as current), the board of health shall investigate cases to determine the source of infection. Refer to Provincial Reporting Requirements above for relevant data to be collected during case investigation.

In addition the following disease-specific information should also be obtained during the incubation period:

- Food, water and other exposure histories such as animal contact in the 10 days prior to symptom onset;

- Contact with a known case or person with symptoms compatible with *E. coli* in the 10 days prior to symptom onset; and
- History of occupation involving susceptible populations, food handling, childcare and healthcare.

## Education

Provide education about disease transmission, appropriate personal hygiene and food handling practices.<sup>3</sup>

Advise the case against attending swimming pools, hot tubs or water spray parks until 48 hours after their symptoms have resolved.<sup>6</sup>

## Treatment

Use of antibiotics is not recommended. Treatment of VTEC is largely supportive and may require hospital admission.<sup>14</sup>

## Exclusion

Exclude symptomatic food handlers, healthcare providers, and day care staff and attendees until the provision of 2 consecutive negative stool specimens or rectal swabs taken at least 24 hours apart and at least 48 hours after the completion of antibiotic and/or anti-diarrheal therapy medications, if these medications have been used.<sup>16</sup>

If the healthcare setting is a hospital, use the "[Enteric Diseases Surveillance Protocol for Ontario Hospitals](#)" (OHA and OMA Joint Communicable Diseases Surveillance Protocols Committee, 2017 or as current) for exclusion criteria.

## Special Considerations

- The medical officer of health or designate may modify this requirement to permit food handlers and healthcare workers with good personal hygiene to return to work without specimen submission. In this instance, the case should, at a minimum, be symptom free for at least 24 hours.
- Exclude asymptomatic culture positive children and childcare providers from

child care settings until the provision of 2 negative stool specimens or rectal swabs collected at least 24 hours apart or 48 hours following the completion of anti-diarrheal or antibiotic therapy.

## Contact Management

Contacts include household members, or other persons who have had close contact with the case or shared the suspected exposure.

Contacts should be instructed about disease transmission, appropriate personal hygiene and contact precautions when providing care for diapered or incontinent cases.

Assess household and other contacts for symptoms and if symptomatic advise to seek medical care. Management and exclusion of symptomatic contacts is the same as for cases.

### Special Consideration for Child Care Centres

If a case is identified in a child care setting, and the source is unknown, consider submission of at least one stool specimen or rectal swabs from children in the same classroom, regardless of symptom history. Counsel both parents and staff regarding symptom presentation and asymptomatic carriage in children.<sup>7</sup>

## Outbreak Management

Please see the *Infectious Diseases Protocol, 2018* (or as current) for the public health management of outbreaks or clusters in order to identify the source of illness, manage the outbreak and limit secondary spread.

Two or more cases linked in time and place to a common exposure is suggestive of an outbreak.

For more information regarding specimen collection and testing, please see the [Public Health Inspector's Guide to the Environmental Microbiology Laboratory Testing](#) (2021, or as current).<sup>8</sup>

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

## Prevention and Control Measures

### Personal Prevention Measures

Food Handling:

- Minimize cross contamination through the use of safe food handling techniques;
- Practice proper hand hygiene after using sanitary facilities, handling raw foods, contact with farm animals or the farm environment (e.g., petting zoos), and before handling food;
- Thoroughly cook all food derived from animal sources, especially ground beef;
- Treat or boil water intended for consumption;
- Conduct routine bacteriological analysis of private drinking water supplies;
- Consume only pasteurized juices, milk and dairy products; and
- Wash fresh fruits and vegetables under potable running water.

For more food safety prevention measures, please see the Ministry of Health's food safety "[Frequently Asked Questions](#)".

### Infection Prevention and Control Strategies

Routine and contact practices are recommended for incontinent and diapered cases for hospitalized cases.

Refer to [PHO's website](#) to search for the most up-to-date information on Infection Prevention and Control (IPAC).



# Disease Characteristics

**Aetiologic Agent** - Verotoxin-producing *Escherichia coli* (VTEC), also known as Shiga toxin-producing *Escherichia coli* (STEC), is a highly pathogenic subtype of *E. coli*. VTEC are distinguished from other *Escherichia coli* (*E. coli*) by the ability to produce Shiga toxins (also referred to as verotoxins), or by the presence of genes encoding those toxins.<sup>1-3</sup>

*E. coli* O157:H7 is most commonly associated with infection in humans. However, the clinical relevance of non-O157 subtypes of VTEC has been increasingly recognized.<sup>1</sup>

**Modes of Transmission** - Transmitted by the fecal-oral route mainly by ingestion of contaminated food and direct contact with animals and their environment. Ground beef is a common source of infection, but other known sources include fresh produce (such as lettuce, spinach, coleslaw, sprouts and melons) and unpasteurized milk and beverages (such as apple cider and orange juice).<sup>1</sup>

Waterborne transmission can occur through the ingestion of contaminated drinking water or recreational water.<sup>1</sup>

Animal-to-person transmission can occur at farms and petting zoos.<sup>1</sup>

Person-to-person transmission most frequently occurs in settings (e.g., day nurseries) where personal hygiene practices are inadequate.<sup>1</sup>

**Incubation Period** – 2–10 days, with a median of 3–4 days.<sup>1</sup> HUS typically develops 7 days (up to 3 weeks) after onset of diarrhea.<sup>3</sup>

**Period of Communicability** - Variable, as long as organisms are excreted; the duration of excretion of the pathogen is typically 1 week or less in adults but can be 3 weeks in one third of children. Prolonged carriage is uncommon.<sup>1</sup>

**Reservoir** - The most important reservoir is infected dairy and beef cattle, but other animals such as sheep, pigs and goats can also be infected. Humans may serve as a reservoir for person-to-person spread.<sup>1</sup>

**Host Susceptibility and Resistance** - The infectious dose is very low.<sup>1</sup> Little is known about differences in susceptibility and immunity, but infections occur in all ages. Children under five years are most frequently diagnosed with infection and are

at greatest risk of developing HUS. The elderly also appear to be at increased risk of complications.<sup>1</sup>

Please refer to [PHO's Reportable Disease Trends in Ontario reporting tool](#) for the most up-to-date information on infectious disease trends in Ontario.

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

## Comments

- O157 strains of VTEC that do not include the H7 motility factor nonetheless meet case definition
- Non-O157 VTEC strains also meet case definition
- Although VTEC has been renamed to Shiga toxin-producing *E. coli*, this is not reflected in Ontario's Reportable Diseases Regulation

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# Document History

<b>Revision Date</b>	<b>Document Section</b>	<b>Description of Revisions</b>
April 2022	Entire Document	New template. Appendix A and B merged. No material content changes.
April 2022	Epidemiology: Occurrence section	Removed.
April 2022	ICD Codes	Removed.