Shiga toxin-producing *Escherichia coli* (STEC) Infection

Disease Plan

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Last updated: April 25, 2018 by Laine McCullough.

Questions about this disease plan?

Contact the Utah Department of Health Bureau of Epidemiology: 801-538-6191.
CRITICAL CLINICIAN INFORMATION

<table>
<thead>
<tr>
<th>Clinical Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs/Symptoms</td>
</tr>
<tr>
<td>• Diarrhea</td>
</tr>
<tr>
<td>• Bloody diarrhea</td>
</tr>
<tr>
<td>• Abdominal cramps</td>
</tr>
<tr>
<td>• Nausea</td>
</tr>
<tr>
<td>• Vomiting</td>
</tr>
<tr>
<td>Period of Communicability</td>
</tr>
<tr>
<td>• The illness usually lasts 5-10 days (about 2 weeks in cases of HUS) and most people are not infectious about a week after diarrhea stops. However, in young children, the organism can persist in the stool for weeks.</td>
</tr>
<tr>
<td>Incubation Period</td>
</tr>
<tr>
<td>• Symptoms generally begin 1-10 days after becoming infected, with a median of 3-4 days.</td>
</tr>
<tr>
<td>Mode of Transmission</td>
</tr>
<tr>
<td>• Person-to-person – Contact with infected person</td>
</tr>
<tr>
<td>• Animal-to-person – Contact with infected animal’s feces</td>
</tr>
<tr>
<td>• Waterborne – Ingesting water that is contaminated with sewage</td>
</tr>
<tr>
<td>• Foodborne – Eating food contaminated by animals or food handlers, drinking unpasteurized milk or juice, or eating raw foods rinsed off with contaminated water</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Laboratory Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Lab Test/Timing of Specimen Collection</td>
</tr>
<tr>
<td>• Routine lab tests include:</td>
</tr>
<tr>
<td>o Enzyme Immunoassay (EIA)</td>
</tr>
<tr>
<td>o Polymerase Chain Reaction (PCR)</td>
</tr>
<tr>
<td>o Culture</td>
</tr>
<tr>
<td>Type of Specimens</td>
</tr>
<tr>
<td>• Feces</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Treatment</td>
</tr>
<tr>
<td>• Non-specific supportive therapy, including hydration, is important. Antibiotics should not be used to treat this infection.</td>
</tr>
<tr>
<td>Time Period to Treat</td>
</tr>
<tr>
<td>• Treatment is not usually needed</td>
</tr>
<tr>
<td>Prophylaxis</td>
</tr>
<tr>
<td>• None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contact Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation of Case</td>
</tr>
<tr>
<td>• Children in childcare settings and food handlers should be excluded from childcare or work until diarrhea has resolved, and they have two negative stool tests collected 24 hours apart.</td>
</tr>
<tr>
<td>• Students should not attend school until diarrhea has resolved.</td>
</tr>
<tr>
<td>Quarantine of Contacts</td>
</tr>
<tr>
<td>• Epi-linked food handlers with diarrhea should be treated the same as a confirmed case, and should be excluded from work.</td>
</tr>
<tr>
<td>Infection Control Procedures</td>
</tr>
<tr>
<td>• Standard and Enteric Precautions</td>
</tr>
</tbody>
</table>
WHY IS STEC IMPORTANT TO PUBLIC HEALTH?

*Escherichia coli*, or *E. coli*, are a diverse group of bacteria found around the world and in the United States (U.S.). Most strains of *E. coli* are harmless, though some can cause serious disease. The most common type of disease producing *E. coli* is Shiga toxin-producing *Escherichia coli* (STEC). STEC can cause illness that ranges from mild diarrhea to bloody diarrhea, and life-threatening hemolytic uremic syndrome (HUS), which complicates 6-9% of cases. STEC are categorized into serogroups by their somatic O antigen. The STEC serogroup most commonly identified and associated with severe illness in the U.S. is *E. coli* O157; however, there are over 50 other serogroups that can cause illness.

An estimated 265,000 STEC infections occur in the U.S. each year, though most of these are not reported to public health authorities because many individuals do not seek health care, or are not tested for STEC O157, or other STEC. It is important to investigate suspected STEC outbreaks to identify the cause of the outbreak (i.e., implicated food item and setting where transmission occurred) and to take action to prevent further illnesses. Additionally, the information collected in an outbreak investigation can be used to gain insight into the pathogen causing illness, and to develop and refine STEC prevention efforts.

DISEASE AND EPIDEMIOLOGY

Clinical Description

Infection with STEC may present with a wide spectrum of clinical manifestations. An individual may be asymptomatic, have relatively mild diarrhea, or have grossly bloody diarrhea. Abdominal cramps, nausea, and vomiting may also be present. Fever is usually absent. Most diagnosed cases present with bloody diarrhea 6-48 hours after the onset of non-bloody diarrhea. Most people get better within 5-7 days. In severe cases, the patient may progress to develop HUS and thrombocytopenic purpura (TTP), which can result in renal failure and death. TTP is a rare blood disorder where blood clots form in small blood vessels throughout the body. HUS is a serious disease in which red blood cells are destroyed and the kidneys fail. Transfusions of blood or blood clotting factors as well as renal dialysis may be needed. A prolonged hospital stay is often required.

Causative Agent

*Escherichia coli* is a gram-negative bacterium that is a part of the normal flora of the bowels. There are over one hundred different serotypes of *E. coli*, most of which do not cause human illness. Some strains of *E. coli*, such as O157:H7 and several other serotypes (e.g., O26, O111), contain genes that produce potent cytotoxins, called Shiga toxins, which give the bacteria the ability to attach to epithelial cells and cause disease. These strains are usually referred to as enterohemorrhagic *E. coli* (EHEC) or Shiga toxin-producing *E. coli* (STEC).
Differential Diagnosis
The differential diagnosis for STEC includes salmonellosis, shigellosis, *Yersinia enterocolitica*, and bacterial food poisoning.

Laboratory Identification
There are a variety of laboratory tests and algorithms that may be used for the diagnosis of STEC. Some laboratories will perform a screen for STEC as part of their routine enteric pathogen cultures, but in other laboratories, a separate test must be ordered. *E. coli* O157 is a common strain of STEC, but other strains, such as O121 and O26, can also cause significant disease and/or HUS. Many labs only screen for O157 and will not be able to identify O121 or other strains.

Culture Independent Diagnostic Testing (CIDT)
Polymerase Chain Reaction (PCR) is a test that amplifies the DNA in an organism. Recently, laboratories have started to use rapid film array panels that test for numerous organisms at the same time. Many laboratories in Utah that utilize PCR tests use either the BioFire FilmArray® or the VERIGENE®.

Enzyme Immunoassay (EIA) is a test that identifies the presence of Shiga toxin in the stool. This test will identify most STEC cases. Laboratories employing any CIDT method should send positive stool samples to the Utah Public Health Laboratory (UPHL) to see if the specific causative agent can be identified.

Culture
Some laboratories culture for O157, but not for other strains of STEC. Studies in Utah show that roughly 50% of the STEC isolates are strains other than O157. Therefore, a negative test for O157 does not rule out the possibility of STEC infection.

It is important to test for this organism so that outbreaks can be identified and controlled. Public health can fingerprint the isolates to determine outbreak linkages.

Utah Public Health Laboratory (UPHL): All positive isolates or stool from culture-independent diagnostic tests (CIDTs) are required by the Communicable Disease Rule to be sent to UPHL for culture isolation and serotyping.

Antibody Titer
The CSTE case definition includes identification of an elevated antibody titer against a known Shiga toxin-producing serogroup of *E. coli* as criteria under laboratory evidence. The Centers for Disease Control and Prevention (CDC) offers serology for STEC O157 and O111. However, this is only offered for HUS with the CDC’s approval. There have been no Utah cases that have had this test performed.
Classification of Shiga toxin-producing *E. coli* (STEC) Cases

- Was *E. coli* isolated?
  - Yes
    - Was the *E. coli* O157?
      - Yes
        - H7 antigen confirmed?
          - Yes
            - Confirmed Case
          - No
            - No
              - Abdominal Cramps or Diarrhea?
                - Yes
                  - Probable Case
                - No
                  - Suspect Case
          - No
            - E. coli O157 or STEC detected using a CDT?
              - Yes
                - Abdominal Cramps or Diarrhea?
                  - Yes
                    - Probable Case
                  - No
                    - Suspect Case
              - No
                - Shiga Toxin identified by a CDT?
                  - Yes
                    - Confirmed Case
                  - No
                    - Shiga Toxin identified by a CDT?
                      - Yes
                        - Confirmed Case
                      - No
                        - Not a Case
                  - No
                    - Not a Case
  - No
    - Abdominal Cramps or Diarrhea?
      - Yes
        - Probable Case
      - No
        - Suspect Case
    - Shiga Toxin identified by a CDT?
      - Yes
        - Confirmed Case
      - No
        - Not a Case
  - No
    - Abdominal Cramps or Diarrhea?
      - Yes
        - Probable Case
      - No
        - Suspect Case
    - Shiga Toxin identified by a CDT?
      - Yes
        - Confirmed Case
      - No
        - Not a Case
    - Elevated antibody titer against STEC (rarely occurs)?
      - Yes
        - Abdominal Cramps or Diarrhea?
          - Yes
            - Probable Case
          - No
            - Not a Case
        - No
          - Suspect Case
      - No
        - Abdominal Cramps or Diarrhea?
          - Yes
            - Probable Case
          - No
            - Not a Case

**STEC Cases without Laboratory Evidence**

- HUS or TTP Diagnosis?
  - Yes
    - Probable case of STEC?
      - Yes
        - Probable
      - No
        - Suspect
    - Abdominal Cramps or Diarrhea?
      - Yes
        - Probable
      - No
        - Not a Case
  - No
    - Not a Case
Treatment
Non-specific supportive therapy, including hydration, is important. Antibiotics should not be used to treat this infection. There is no evidence that treatment with antibiotics is helpful, and taking antibiotics may increase the risk of HUS. Antidiarrheal agents like Imodium® may also increase that risk.

Case Fatality
Around 6-9% of those who are diagnosed with STEC, and about 15% of children under the age of 10 years, develop the potentially life-threatening complication HUS when infected with STEC. Among patients who develop HUS, up to 50% require dialysis during the acute phase of illness, and mortality rate for those who develop HUS is 3-5%. Though rates can vary by disease and serotype, it is known that about 5% of patients who developed HUS as a result of *E. coli* O157:H7 die.

Reservoir
Cattle appear to be a reservoir of significant public health importance. Other animals, such as deer, sheep, and goats, are also known to carry STEC. In addition, humans may serve as a reservoir for person-to-person transmission.

Transmission
STEC transmission can be foodborne, waterborne, spread from animal-to-person, or from person-to-person through fecal-oral transmission. Foodborne transmission occurs when a person eats food containing the bacteria. The bacteria live in the intestine of some healthy cattle, and contamination of meat may occur in the slaughtering process. Eating meat, especially ground beef that is rare or not fully cooked, is the most common mechanism of infection. Other possible foodborne causes include drinking unpasteurized milk, or eating unwashed fruits or vegetables that have been fertilized with cow manure. Waterborne transmission can occur by drinking or swimming in water that is contaminated with sewage. Animal-to-person transmission can occur when a person comes into contact with the feces of an infected animal. Person-to-person transmission can occur if infected persons do not wash their hands after using the toilet or after changing diapers. Sexual contact has also been shown to transmit the bacteria. Transmission requires a low infectious dose, and large outbreaks can occur.

Susceptibility
Persons of all ages are at risk for infection. Young children, the elderly, and those with compromised immune systems are the most likely to develop HUS and are the most severely affected. Peak incidence of disease occurs in the late summer months.

Incubation Period
The incubation period for STEC is 1-10 days, with a median of 3-4 days.
**Period of Communicability**
The illness usually lasts 5-10 days (about 2 weeks in cases of HUS) and most people are not infectious about a week after diarrhea stops. However, in young children the organism can persist in the stool for weeks.

**Epidemiology**
The most commonly isolated STEC serotype in North America is *E. coli* O157:H7, this serotype is believed to account for nearly 90% of all diarrhea-associated HUS cases. Utah consistently has high incidence rates for STEC. Based on laboratory reporting, in 2015, incidence of STEC infections in Utah was 2.8, compared to the U.S. incidence rate of 1.5 infections per 100,000 people. Outbreaks in the U.S. have been associated with romaine lettuce, ground beef, unpasteurized milk and apple cider, and other food products. Outbreaks have also been linked to petting zoos and other animal-contact settings.

**PUBLIC HEALTH CONTROL MEASURES**

**Public Health Responsibility**
- Investigate all cases of disease and fill out and submit appropriate disease investigation forms.
- Provide education to the general public, clinicians, and first responders regarding disease transmission and prevention.
- Identify cases and sources to prevent further transmission.
- Identify clusters or outbreaks of this disease and determine the source.

**Prevention**

**Environmental Measures**
Implicated food items must be removed from consumption. A decision about testing implicated food items can be made in consultation with the enteric epidemiologist at UDOH and UPHL.

The general policy of UPHL is to test only food samples implicated in suspected outbreaks, not in singles cases (except when botulism is suspected). If holders of food implicated in single case incidents would like their food tested, they may be referred to a private laboratory that will test food or store the food in their freezer for a period of time in case additional reports are received. However, in certain circumstances, a single, confirmed case with leftover food that had been consumed within the incubation period may be considered for testing.

**Personal Preventive Measures/Education**
To avoid exposure and transmission, individuals should:
- Always wash their hands thoroughly with soap and water before eating or preparing food, after using the toilet, after changing diapers, and after contact with animals, especially cattle.
- Wash their own hands as well as the child’s hands after changing a child’s diaper, and dispose of diapers in a closed-lid garbage can.
• Wash their hands thoroughly and frequently when ill with diarrhea, or when caring for someone with diarrhea. Hands should be scrubbed for at least 15-20 seconds after cleaning the bathroom, after using the toilet or helping someone use the toilet, after changing diapers, before handling food, and before eating.
• Keep food that will be eaten raw, such as vegetables, from becoming contaminated by animal-derived food products. (Wash fruits and vegetables thoroughly, especially those that will not be cooked.)
• Do not eat hamburger or other ground beef products that have not been fully cooked. Cook all ground beef and hamburger thoroughly. Make sure the cooked meat is brown throughout (not pink), and the juices run clear. If served an undercooked hamburger or other undercooked ground beef product in a restaurant, send it back for further cooking.
• Cook all ground beef and hamburgers thoroughly, and always use a food thermometer. Beef steaks and roasts should be cooked to a minimum internal temperature of 145°F (62.6°C). Ground beef should be cooked to a minimum internal temperature of 160°F (70°C).
• Drink only pasteurized milk, juice, or cider.
• Water which is possibly infected (when pipes leak or are undergoing repairs, for example) should be treated with adequate levels of chlorine or other effective disinfectants or boiled to guard against chance contamination.

Discuss transmission risks that may result from oral-anal sexual contact. Latex barrier protection (i.e., dental dam) may prevent the spread of *E. coli* to a case’s sexual partners and may prevent exposure to and transmission of other fecal-oral pathogens.

**Food Handling Measures**

**General Handling**

• Ground beef should be frozen or refrigerated at 45°F or less as soon as possible after it is purchased and kept refrigerated until it is used.
• Ground beef should be packaged and stored so that its juices (blood) do not drip onto other foods.
• Never reuse packaging materials.
• Be careful not to recontaminate meat by placing cooked meat on the same platter or surface that held the raw meat, or by using utensils which have been contaminated by raw meat.
• Utensils, dishes, and surfaces which come in contact with raw meat should be washed with soap and water before they are used again.

**Storing**

• Ground beef should be stored at 45°F or below.
• Ground beef may be stored frozen for up to four months and in the refrigerator for 1-2 days.

**Cooking**

• Cook ground beef until it is completely cooked throughout (no pink in the middle) and the juices run clear. Ground beef should be cooked to 160°F or above. Do not cook ground beef in a microwave oven because cooking may be uneven.
• Any cooked hamburger left at room temperature for more than two hours should be discarded.
• After cooking, ground beef can be stored in the refrigerator for 3-4 days or frozen for up to three months.

Reheating
• Reheat fully cooked ground beef and hamburger patties to 165°F or above.

Chemoprophylaxis
None.

Vaccine
None.

Isolation and Quarantine Requirements

Isolation: Food handlers with *E. coli* infection must be excluded from work. After diarrhea has resolved, food handling facility employees may only return to work after producing two negative stool specimens collected 24 hours apart. If a case has been treated with an antimicrobial, the stool specimen shall not be collected until at least 48 hours after cessation of therapy.

NOTE: A food handler is any person directly preparing or handling food. This can include a patient care or childcare provider.

Hospital: Enteric precautions.

Quarantine: Contacts who have diarrhea and are food handling facility employees shall be considered the same as a case and shall be handled in the same fashion. In outbreak circumstances involving a facility, asymptomatic contacts who are food handling employees may be required to submit stool specimens for testing.

✔ CASE INVESTIGATION

Reporting
Report any illness to public health authorities that meets any of the following criteria:
1. Any person with *E. coli* O157:H7 or *E. coli* O157:H7 from a clinical specimen.
2. Any person with STEC isolated from a clinical specimen.
3. Any person with an elevated antibody titer against a known Shiga toxin-producing serogroup of *E. coli*.
4. Any person with Shiga toxin, Shiga toxin genes, *E. coli* O157, or STEC/EHEC detected in a clinical specimen using a CIDT.
5. Any person with abdominal cramps or diarrhea who is a contact of an STEC case or a member of a risk group defined by public health authorities during an outbreak investigation.
6. Any person with a diagnosis of post-diarrheal hemolytic uremic syndrome (HUS).
7. Any person with a diagnosis of post-diarrheal thrombotic thrombocytopenic purpura (TTP).
8. A person whose healthcare record contains a recent diagnosis of STEC infection.
9. A person whose death certificate lists STEC as a cause of death or a significant condition contributing to death.

Other recommended reporting procedures:
- All cases of STEC should be reported.
- Reporting should be ongoing and routine.
- Frequency of reporting should follow the state health department's routine schedule (in Utah, within three working days of identification).

**Reporting Table**
Requirements for reporting are established under State and Territorial laws and/or regulations and may differ from jurisdiction to jurisdiction. These criteria are suggested as a standard approach to identifying cases of this condition for purposes of reporting, but reporting should follow state and territorial law/regulation if any conflicts occur between these criteria and those laws/regulations.

<table>
<thead>
<tr>
<th>Table of criteria to determine whether a case should be reported to public health authorities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Criterion</strong></td>
</tr>
<tr>
<td><strong>Clinical evidence</strong></td>
</tr>
<tr>
<td>Abdominal cramps</td>
</tr>
<tr>
<td>Diarrhea</td>
</tr>
<tr>
<td>Diagnosis of post-diarrheal hemolytic uremic syndrome (HUS)</td>
</tr>
<tr>
<td>Diagnosis of post-diarrheal thrombotic thrombocytopenic purpura (TTP)</td>
</tr>
<tr>
<td>Healthcare record contains a recent diagnosis of STEC infection</td>
</tr>
<tr>
<td>Death certificate lists STEC as a cause of death or a significant condition contributing to death</td>
</tr>
<tr>
<td><strong>Laboratory evidence</strong></td>
</tr>
<tr>
<td>Isolation of <em>E. coli</em> O157:H7 from a clinical specimen</td>
</tr>
<tr>
<td>Isolation of <em>E. coli</em> from a clinical specimen with detection of Shiga toxin or Shiga toxin genes</td>
</tr>
<tr>
<td>Isolation of <em>E. coli</em> O157 from a clinical specimen, without confirmation of H antigen, detection of Shiga toxin or detection of Shiga toxin genes</td>
</tr>
<tr>
<td>Identification of an elevated antibody titer against a known Shiga toxin-producing serogroup of <em>E. coli</em></td>
</tr>
<tr>
<td>Detection of Shiga toxin, Shiga toxin genes, <em>E. coli</em> O157, or STEC/EHEC in a clinical specimen using a CIDT</td>
</tr>
<tr>
<td><strong>Epidemiologic evidence</strong></td>
</tr>
<tr>
<td>Epidemiologically linked to an STEC case</td>
</tr>
<tr>
<td>Member of a risk group defined by public health authorities during an outbreak investigation</td>
</tr>
</tbody>
</table>

Notes:
S = This criterion alone is Sufficient to report a case.
Case Definition

**Shiga toxin-producing *Escherichia coli* (STEC) (2018)**

**Clinical Description**
An infection of variable severity characterized by diarrhea (often bloody) and/or abdominal cramps. Illness may be complicated by HUS (note that some clinicians still use the term thrombotic thrombocytopenic purpura [TTP] for adults with post-diarrheal HUS).

**Laboratory Criteria**

*Laboratory confirmed*
- Isolation of *E. coli* O157:H7 from a clinical specimen, **OR**
- Isolation of *E. coli* from a clinical specimen with detection of Shiga toxin or Shiga toxin genes.

*Supportive laboratory results*
- Isolation of *E. coli* O157 from a clinical specimen without confirmation of H antigen, detection of Shiga toxin, or detection of Shiga toxin genes, **OR**
- Identification of an elevated antibody titer against a known Shiga toxin-producing serogroup of *E. coli*, **OR**
- Detection of Shiga toxin or Shiga toxin genes in a clinical specimen using a CIDT and no known isolation of *Shigella* from a clinical specimen, **OR**
- Detection of *E. coli* O157 or STEC/EHEC in a clinical specimen using a CIDT.

**Epidemiologic Linkage**
- A clinically compatible illness in a person that is epidemiologically linked to a confirmed or probable case with laboratory evidence, **OR**
- A clinically compatible illness in a person that is a member of a risk group as defined by public health authorities during an outbreak.

**Criteria to distinguish a new case of this disease or condition from reports or notifications which should not be enumerated as a new case for surveillance**
- A new case should be created when a positive laboratory result is received more than 180 days after the most recent positive laboratory result associated with a previously reported case in the same individual, **OR**
- When two or more different serogroups/serotypes are identified in one or more specimens from the same individual, each serogroup/serotype should be reported as a separate case.
Shiga toxin-producing *Escherichia coli*: Utah Public Health Disease Investigation Plan

**Comments**

Asymptomatic infections and infections at sites other than the gastrointestinal tract in people (1) meeting the confirmatory laboratory criteria for diagnosis, or (2) with isolation of E. coli O157 from a clinical specimen without confirmation of H antigen, detection of Shiga toxin, or detection of Shiga toxin genes, are considered STEC cases and should be reported.

Although infections with Shiga toxin-producing organisms in the United States are primarily caused by STEC, in recent years an increasing number are due to infections by Shiga toxin-producing *Shigella*. Persons with (1) detection of Shiga toxin or Shiga toxin genes using a CIDT and (2) isolation of *Shigella* spp. from a clinical specimen should not be reported as an STEC case.

Due to the variable sensitivities and specificities of CIDT methods and the potential for degradation of Shiga toxin in a specimen during transit, discordant results may occur between clinical and public health laboratories. Persons with (1) detection of Shiga toxin or Shiga toxin genes using a CIDT and (2) the absence of isolation of *Shigella* from a clinical specimen should be reported as a probable case, regardless of whether detection of Shiga toxin or Shiga toxin genes is confirmed by a public health laboratory.

**Case Classification**

*Confirmed:*
- A person that meets the confirmatory laboratory criteria for diagnosis.

*Probable:*
- A person with isolation of *E. coli* O157 from a clinical specimen without confirmation of H antigen, detection of Shiga toxin, or detection of Shiga toxin genes, **OR**
- A clinically compatible illness in a person with identification of an elevated antibody titer against a known Shiga toxin-producing serogroup of *E. coli*, **OR**
- A clinically compatible illness in a person with detection of Shiga toxin or Shiga toxin genes in a clinical specimen using a CIDT and no known isolation of *Shigella* from a clinical specimen, **OR**
- A clinically compatible illness in a person with detection of *E. coli* O157 or STEC/EHEC from a clinical specimen using a CIDT, **OR**
- A clinically compatible illness in a person that is epidemiologically linked to a confirmed or probable case with laboratory evidence, **OR**
- A clinically compatible illness in a person that is a member of a risk group as defined by public health authorities during an outbreak.

*Suspect:*
- A person that meets the supportive laboratory criteria for diagnosis with no known clinical compatibility, **OR**
- A person with a diagnosis of post-diarrheal HUS/TTP (see HUS case definition).
## Classification Table

### Criteria for defining cases of STEC.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Confirmed</th>
<th>Probable</th>
<th>Suspect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical evidence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal cramps</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Diagnosis of post-diarrheal HUS/TTP</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Absence of abdominal cramps and diarrhea</td>
<td></td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td>O</td>
<td></td>
</tr>
<tr>
<td><strong>Laboratory evidence</strong></td>
<td>N</td>
<td>N</td>
<td>O</td>
</tr>
<tr>
<td>Isolation of <em>E. coli</em> O157: H7 from a clinical specimen</td>
<td>N</td>
<td>N</td>
<td>O</td>
</tr>
<tr>
<td>Isolation of <em>E. coli</em> from a clinical specimen</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Isolation of <em>E. coli</em> O157 from a clinical specimen without confirmation of H antigen</td>
<td></td>
<td>N</td>
<td>O</td>
</tr>
<tr>
<td>Identification of an elevated antibody titer against a known Shiga toxin-producing serogroup of <em>E. coli</em></td>
<td>N</td>
<td>N</td>
<td>O</td>
</tr>
<tr>
<td>Detection of Shiga toxin or Shiga toxin genes in a clinical specimen using a CIDT</td>
<td>N</td>
<td>N</td>
<td>O</td>
</tr>
<tr>
<td>Detection of <em>E. coli</em> O157 or STEC/EHEC in a clinical specimen using a CIDT</td>
<td></td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Absence of isolation of <em>Shigella</em> from a clinical specimen</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Absence of detection of Shiga toxin or Shiga toxin genes in a clinical specimen using a CIDT</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td><strong>Epidemiologic evidence</strong></td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Epidemiologically linked to a confirmed or probable STEC case with laboratory evidence</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Member of a risk group as defined by the public health authorities during an outbreak investigation</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td><strong>Criteria to distinguish a new case</strong></td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>A positive laboratory result reported more than 180 days after the most recent positive laboratory result associated with a previously reported case in the same individual</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Two or more different STEC serogroups/serotypes identified in one or more specimens from the same individual</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

**Notes:**

S = This criterion alone is Sufficient to classify a case.

N = All "N" criteria in the same column are Necessary to classify a case. A number following an "N" indicates that this criterion is only required for a specific disease/condition subtype.

O = At least one of these "O" (One or more) criteria in each category (i.e., clinical evidence and laboratory evidence) in the same column—in conjunction with all "N" criteria in the same column—is required to classify a case.
Case Investigation Process

- All suspect, probable, and confirmed cases should be interviewed with the STEC case report form.
- Food handlers should be excluded from work until diarrhea has resolved and two stool specimens are negative.
- Assure isolate submission to UPHL.

Outbreaks

CDC defines a foodborne outbreak as "an incident in which two or more persons experience a similar illness resulting from the ingestion of a common food." To confirm an outbreak of STEC, the same *E. coli* species must be isolated from clinical specimens from at least two ill persons or the species must be isolated from an epidemiologically implicated food. The source of the infection should be identified and measures to identify additional ill persons and/or to remove the source from consumers should be taken.

Identify Case Contacts

Contacts of STEC cases may include household contacts, childcare and school attendees and workers, and food handlers. Contacts should be interviewed to determine if they have symptoms that may indicate they are also infected with STEC. Contacts may be identified through interview of the case-patient or physician notes. More information about management of symptomatic case contacts is listed in the "Case Contact Management" section below.

Case Contact Management

Childcare

Since Shiga toxin-producing *E. coli* may be transmitted from person to person through fecal-oral transmission, it is important to follow up on cases, and symptomatic contacts of cases, of STEC in a childcare setting carefully. (If a case of HUS is diagnosed in a childcare, please see the Hemolytic Uremic Syndrome (HUS) disease plan). General recommendations include:

- Children with STEC infection who have diarrhea should be excluded until their diarrhea is resolved and they have two negative stool tests collected 24 hours apart and at least 48 hours after completion of antibiotic therapy, if antibiotics are given.
- Children with STEC infection who have no diarrhea are subject to the same testing requirements above.
- Since most staff in childcare programs are considered food handlers, those with STEC in their stools (symptomatic or not) can remain on site, but they must not prepare food or feed children until their diarrhea is resolved and they have two negative stool tests taken at least 24 hours apart and submitted at least 48 hours after completion of antimicrobial therapy, if treatment is received.

School

Since Shiga toxin-producing *E. coli* may be transmitted from person-to-person through fecal-oral transmission, it is important to follow up on cases, and symptomatic contacts of cases, of STEC
in a school setting carefully. (If a case of HUS is diagnosed in a childcare facility, please see the Hemolytic Uremic Syndrome (HUS) disease plan). General recommendations include:

- Students or staff with STEC infection who have diarrhea should be excluded until their diarrhea is resolved.
- Students or staff with STEC who do not handle food, have no diarrhea or mild diarrhea, and are not otherwise sick, may remain in school if special precautions are taken.
- Students or staff who handle food and have STEC infection (symptomatic or not) must not prepare food until their diarrhea is resolved and they have two negative stool tests taken at least 24 hours apart and submitted at least 48 hours after completion of antimicrobial therapy, if treatment is received.

**Food Handlers**

Since Shiga-toxin producing *E. coli* may be transmitted from person-to-person through fecal-oral transmission, it is important to follow up on cases, and symptomatic contacts of cases, of STEC in a food handling facility setting. (If a case of HUS is diagnosed in a childcare facility, please see the Hemolytic Uremic Syndrome (HUS) disease plan). General recommendations include:

- Staff with STEC infection who have diarrhea should be excluded until their diarrhea is resolved.
- Staff members who test positive for STEC (symptomatic or not) and who handle food must not prepare food until their diarrhea is resolved and they have two negative stool tests taken at least 24 hours apart and submitted at least 48 hours after completion of antimicrobial therapy, if treatment is received.

**Healthcare Workers/Community Residential Programs**

Actions taken in response to a case of Shiga toxin-producing *E. coli* in a healthcare worker or a resident or staff member of a community residential program will depend on the type of facility.

In long-term care facilities, residents with Shiga toxin-producing *E. coli*, and symptomatic contacts of cases, should be placed on standard (including enteric) precautions until their symptoms subside and they have two negative stool specimens for *E. coli* taken 24 hours apart. Staff members of healthcare facilities or residential programs who give direct patient care (i.e., feed patients, give mouth or denture care, or give medications) are considered food handlers and are subject to food handler restrictions. In addition, staff members with Shiga toxin-producing *E. coli* infection, or who are symptomatic contacts of cases, who are not food handlers should consider not working until diarrhea is resolved.

In residential facilities for the developmentally disabled, staff and clients with STEC, and symptomatic contacts of cases, must refrain from handling or preparing food for other residents until their diarrhea has subsided and they have two negative stool specimens for *E. coli* taken 24 hours apart (and collected at least 48 hours after completion of antibiotic therapy, if antibiotics are given). In addition, staff members with Shiga toxin-producing *E. coli* infection, or who are symptomatic contacts of cases, who are not food handlers should consider not working until their diarrhea is resolved.
ACKNOWLEDGEMENTS

This document is a revision of the Utah Department of Health disease plan for STEC. We would like to acknowledge the Colorado Department of Public Health, the Massachusetts Department of Public Health and Environment, and the New Jersey Department of Health for select content in this document.

REFERENCES


✓ VERSION CONTROL

Updated Dec 2014 – CSTE reporting criteria, case definition, and case classification swim lanes included.


Updated October 2017 – Updated the CSTE position statement and swim lanes for reporting and classification.

Updated January 2018 – “Electronic Laboratory Reporting Processing Rules” section added. Added information regarding CIDT Testing under “Laboratory Identification.” The Classification of Cases chart was updated to reflect the new position statement.

Updated April 2018 – Added information on animal-to-person transmission in “Transmission” section. Included description on Antibody Titer in “Laboratory Identification” section. Added Food Handler section to “Case Contact Management.”
UT-NEDSS Minimum/Required Fields by Tab

Demographic
- Last Name
- First Name
- Date of Birth
- State
- County
- (Area) Phone, Ext
- Birth Sex
- Ethnicity
- Race

Clinical
- Disease
- Onset Date
- Visit type
- Shiga toxin-producing *Escherichia coli* (STEC) caused hospitalization
- Died
- Date of Death
- Shiga toxin-producing *Escherichia coli* (STEC) caused death
- Symptoms:
- Did patient have HUS or TTP?

Laboratory
- Performing Lab
- Collection Date Time
- Specimen Source
- Accession Number
- Test Type
- Organism
- Test Result
- Lab Test Date Time
- PFGE (1st enzyme) (completed by UDOH)
- PFGE (2nd enzyme) (completed by UDOH)
- Serotype (completed by UDOH)

Contacts
- Does case’s infection appear secondary to another person’s infection? If YES, please fill out contact information below.

- Any contacts ill with similar symptoms? If YES, please fill out contact information below.

Investigation
- Food Handler
  - (if yes) What is the name of the facility where the patient handled food?
  - (if yes) Location:
  - (if yes) Did the patient work while ill?
    - (if yes) Important information including dates:
- Healthcare Worker
  - (if yes) What is the name of the healthcare facility?
  - (if yes) Location:
  - (if yes) Did the patient work while ill?
    - (if yes) Important information including dates:
- Group Living
  - (if yes) What is the name of the facility?
  - (if yes) Location:
  - (if yes) Did the patient attend/work while ill?
    - (if yes) Important information including dates:
- Childcare Association
  - (if yes) What is the name of the childcare?
  - (if yes) Location:
  - (if yes) Supervisor name:
  - (if yes) Supervisor phone number:
  - (if yes) Did the patient attend while ill?
    - (if yes) Important information including dates:
- Occupation
- Did the patient eat at any restaurants (fast food/chain/sit-down/cart/kiosk/etc.) in the 7 days before illness?
- Did the patient eat food from any grocery stores during the 7 days before illness?
Investigation cont.

(including farmers’ markets, produce or fruit stand, etc.)?

• Did the patient eat food from any grocery stores during the 7 days before illness (including farmers’ markets, produce or if patient can’t remember, ask where s/he usually purchases groceries).

• Did the patient attend/visit any events during the 7 days before illness?

• Imported From

• Risk Factors

• Risk Factor Notes

• Date 7 days before disease onset:

• Date 1 day before disease onset:

• Did the patient travel outside the U.S. during the exposure period?
  o (if yes) Describe travel (location, dates, mode, if other were ill, etc.):

• Did the patient travel outside Utah, but inside U.S. during the exposure period?
  o (if yes) Describe travel (location, dates, mode, if other were ill, etc.):

• Did the patient travel outside the county, but inside Utah during the exposure period?

• Milk
  o (if yes) Details and source
  o (if yes) Unpasteurized?
    ▪ (if yes) Date(s) of purchase
    ▪ (if yes) Date(s) of consumption
    ▪ (if yes) Was milk ever unrefrigerated >1 hour, including during transport?

• Block cheese (i.e., ched/swiss/mozz)

• Brie/other similar type

• Queso fresco
  o (if yes) Unpasteurized?

• Hamburger/ground beef
  o (if yes) If yes or maybe, cooked
  o (if yes) Pre-made uncooked patties
  o (if yes) Pre-made pre-cooked patties
  o (if yes) Details and source

• Turkey

• Roast beef/steak (carne asada)

Investigation cont.

• (if yes) Details: variety/brand, how prepared, where bought/eaten (store/restaurant)

• Pepperoni/other salami

• Jerky

• Lamb or veal

• Venison (deer meat) / other game

• Fish (not canned tuna/salmon)

• Did you handle any other raw meat at home/anywhere else?

• Iceberg

• Green leaf

• Red leaf

• Romaine

• Mixed greens (mesclun)

• Spinach

• Other leafy greens

• Sprouts
  o If the answer to any of the previous seven food questions was yes, the following question must be asked:
  o (if yes) Details: variety/brand, how prepared, where bought/eaten (store/restaurant)

• Tomatoes

• Watermelon

• Strawberries

• Mango

• Apple juice/cider
  o (if yes) Unpasteurized

• Did the patient visit any of the following during exposure period?

• Specify details:

• Did the patient have contact with animal waste/manure during the exposure period?

• Did the patient have contact with ANY animals (including farm animals, pets) during the exposure period?

• Source of drinking water at home:

• Did the patient drink or have exposure to any of the following during the exposure period?
Investigation cont.
- Did the patient drink or have exposure to any other water sources not listed during the exposure period?
  o (if yes) Specify details (dates, locations, etc.):
- Interview date:
- Person interviewed:
  o (if Unable to Interview) Specify reason for unable to interview (i.e., LTF, refused, etc.)

Reporting
- Date first reported to public health

Administrative
- State case Status (completed by UDOH)
- Outbreak Associated
- Outbreak Name
Shiga toxin-producing *Escherichia coli*: Utah Public Health Disease Investigation Plan

**Electroonic Laboratory Reporting Processing Rules**

Shiga toxin-producing *E. coli* Rules for Entering Laboratory Test Results

The following rules describe how laboratory results reported to public health should be added to new or existing events in UT-NEDSS. These rules have been developed for the automated processing of electronic laboratory reports, although they apply to manual data entry, as well.

**Test-Specific Rules**

*Test specific rules describe what test type and test result combinations are allowed to create new morbidity events in UT-NEDSS, and what test type and test result combinations are allowed to update existing events (morbidity or contact) in UT-NEDSS.*

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Test Result</th>
<th>Create a New Event</th>
<th>Update an Existing Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antigen by EIA/ELISA</td>
<td>Positive</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Culture</td>
<td>Positive</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Identification</td>
<td>Positive</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>PCR/amplification</td>
<td>Positive</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>PFGE</td>
<td>Positive</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Whitelist Rules**

*Whitelist rules describe how long an existing event can have new laboratory data appended to it. If a laboratory result falls outside the whitelist rules for an existing event, it should not be added to that event, and should be evaluated to determine if a new event (CMR) should be created.*

**Shiga toxin-producing *E. coli* Morbidity Whitelist Rule:** If the specimen collection date of the laboratory result is 180 or less after the specimen collection date of the last positive laboratory result, the laboratory result should be added to the morbidity event.

**Shiga toxin-producing *E. coli* Contact Whitelist Rule:** If the specimen collection date of the laboratory result is 30 or less after the event date of the contact event, the laboratory result should be added to the contact event.

**Graylist Rule**

*We often receive laboratory results through ELR that cannot create cases, but can be useful if a case is created in the future. These laboratory results go to the graylist. The graylist rule describes how long an existing event can have an old laboratory result appended to it.*
Shiga toxin-producing *Escherichia coli*: Utah Public Health Disease Investigation Plan

**Shiga toxin-producing E. coli Graylist Rule:** If the specimen collection date of the laboratory result is 30 days before to 7 after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

**Other Electronic Laboratory Processing Rules**
- If an existing event has a state case status of “not a case,” ELR will never add additional test results to that case. New labs will be evaluated to determine if a new CMR should be created.