

# Shiga Toxin–Producing *Escherichia Coli* (STEC)

Including *E. Coli* O157:H7

## DISEASE REPORTABLE WITHIN 24 HOURS OF DIAGNOSIS

Per N.J.A.C. 8:57, healthcare providers and administrators shall report by mail or by electronic reporting within 24 hours of diagnosis, cases of STEC to the health officer of the jurisdiction where the ill or infected person lives, or if unknown, wherein the diagnosis is made. A directory of local health departments in New Jersey is available at <http://localhealth.nj.gov>.



## 1 THE DISEASE AND ITS EPIDEMIOLOGY

### A. Etiologic Agent

*Escherichia coli*, a gram-negative bacterium, has many different serotypes categorized into five major groups that are pathogenic to humans. These groups are designated according to virulence mechanisms: the first four are enterotoxigenic; enteropathogenic; enteroinvasive; and enteroaggregative; the last one includes Shiga toxin-producing *E. coli* (STEC), which was previously known as enterohemorrhagic *E. coli*. The most commonly reported STEC in the United States is *E. coli* O157:H7. Other serotypes such as O26:H11, O111:H8, O103:H2, O113:H21, and O104:H21 have also been implicated as STEC strains.

### B. Clinical Description and Laboratory Diagnosis

STEC bacteria produce potent cytotoxins, called shiga toxins. Infection with STEC, including *E. coli* O157:H7 may present with a wide spectrum of clinical manifestations. An individual may be asymptomatic, have mild non-bloody diarrhea, or have gross bloody diarrhea (hemorrhagic colitis). Most diagnosed cases of *E. coli* O157:H7 present with an onset of bloody diarrhea six to 48 hours after the onset of non-bloody diarrhea. Abdominal cramps, nausea, and vomiting may also be present. Fever is usually absent. Commonly the illness resolves in five to ten days. In severe cases, the patient may progress to develop hemolytic uremic syndrome (HUS), which can result in renal failure and death. Laboratory diagnosis is based on isolation of *E. coli* O157:H7 or another strain of STEC from feces or rectal swabs, by demonstrating the presence of Shiga toxin by enzyme immunoassay or by identifying the presence of toxin genes or virulence plasmids.

### C. Reservoirs

Cattle appear to be a reservoir of significant public health importance; however, other animals, such as deer, are also known to carry STEC. In addition, humans may also serve as a reservoir.

#### **D. Modes of Transmission**

Transmission of STEC infection occurs fecal-orally through food, drinking water, or recreational water contaminated with human or animal feces containing the bacterium. Transmission may also occur directly from person to person; this can include certain types of sexual contact (e.g., oral-anal contact). STEC infection has been associated with the consumption of contaminated foods, such as inadequately cooked ground beef, unpasteurized apple juice and cider, unpasteurized milk and other dairy products, and raw vegetables.

#### **E. Incubation Period**

The incubation period for *E. coli* O157:H7 is two to eight days (or longer), most commonly three to four days. Other STEC serotypes have an incubation period that varies from ten hours to six days.

#### **F. Period of Communicability or Infectious Period**

STEC is shed in stool during at least the initial period of diarrhea, then variably for an unknown duration. These bacteria are shed for up to three weeks in about one-third of infected children. Prolonged carriage is uncommon.

#### **G. Epidemiology**

STEC infection was first identified in 1982 during an outbreak of *E. coli* O157:H7 in the United States. Since then, infections have been recognized as an important cause of bloody diarrhea in North America, Europe, Japan, Australia, and southern South America. As with other enteric illnesses, the young and old are usually more severely ill when infected with STEC. Infection in young children may lead to complications such as HUS in about 5% to 10% of cases. Sporadic cases occur throughout the year with a peak incidence of disease during the summer months. Outbreaks in the United States have been associated with ground beef, unpasteurized milk and apple cider, raw vegetables, and other food products.

## **2 CASE DEFINITION**

### **A. New Jersey Department of Health (NJDOH) Case Definition**

#### **1. Clinical Description**

An infection of variable severity characterized by diarrhea (often bloody) and abdominal cramps. Illness may be complicated by HUS. (Note, some clinicians still use the term thrombotic thrombocytopenic purpura (TTP) for adults with post-diarrheal HUS.); asymptomatic infections also may occur, and the organism may rarely cause extraintestinal infections.

## 2. Laboratory Criteria for Diagnosis

### Laboratory confirmed

- Isolation of STEC from a clinical specimen. *Escherichia coli* O157 isolates that produce the H7 antigen may be assumed to be Shiga toxin-producing. For all other *E. coli* isolates, Shiga toxin production or the presence of Shiga toxin genes must be determined to be considered STEC.
- Both asymptomatic infections and infections at sites other than the gastrointestinal tract, if laboratory confirmed, are considered confirmed cases that should be reported.

### Supportive laboratory results

- A case with isolation of *E. coli* O157 from a clinical specimen, without confirmation of H antigen or Shiga toxin production.
- Identification of an elevated antibody titer to a known STEC serotype from a clinically compatible case.
- Identification of Shiga toxin in a specimen from a clinically compatible case without the isolation of STEC.

## 3. Case Classification

### CONFIRMED

A case that meets the confirmed laboratory criteria for diagnosis.

### PROBABLE

A case with isolation of *E. coli* O157 from a clinical specimen, without confirmation of H antigen or Shiga toxin production, OR

A clinically compatible case who is a contact of an STEC case or is a member of a defined risk group during an outbreak, OR

Identification of an elevated antibody titer to a known STEC serotype from a clinically compatible case.

### POSSIBLE

A case of postdiarrheal HUS (see HUS case definition), OR

Identification of Shiga toxin in a specimen from a clinically compatible case without the isolation of the STEC.

## B. Differences from CDC Case Definition

The formal Centers for Disease Control and Prevention (CDC) surveillance case definition for STEC is the same as the criteria outlined in section 2A. CDC case definitions are used by state health departments and CDC to maintain uniform standards for national reporting. For reporting a case to NJDOH, always refer to the criteria in section 2A.

# 3 LABORATORY TESTING AVAILABLE

The New Jersey Department of Health (NJDOH) Public Health and Environmental Laboratories (PHEL) will test stool specimens for the presence of STEC in an outbreak situation and will also confirm and serotype isolates of STEC obtained from clinical specimens at other laboratories. PHEL requests that all laboratories submit within three days **ALL** STEC isolates and STEC positive broths for further characterization to aid in public health surveillance (NJAC 8:57-1.6 [f]).

The general policy of PHEL is to test only food samples implicated in suspected outbreaks, not in single cases (except when botulism is suspected). The health officer may suggest that persons who possess food items implicated in a sporadic case either locate 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. All testing of food and clinical samples must have prior approval from staff from the Infectious and Zoonotic Diseases Program (IZDP).

# 4 PURPOSE OF SURVEILLANCE AND REPORTING AND REPORTING REQUIREMENTS

## A. Purpose of Surveillance and Reporting

- To identify whether the case-patient may be a source of infection for other persons (e.g., a diapered child, daycare attendee, or food handler) and, if so, to prevent further transmission.
- To identify transmission sources of major public health concern (e.g., a restaurant or commercially distributed food product) and to stop transmission from such sources.
- To provide education about reducing the risk of infection.

## B. Laboratory Reporting Requirements

The New Jersey Administrative Code (NJAC 8:57-1.6) stipulates that laboratories report (using the Communicable Disease Reporting and Surveillance System [CDRSS]) all cases of STEC to the local health officer having jurisdiction over the locality in which the patient lives or, if unknown, to the health officer in whose jurisdiction the healthcare provider requesting the laboratory examination is located. The report shall contain, at a minimum, the

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reporting laboratory's name, address, and telephone number; the age, date of birth, gender, race, ethnicity, home address, and telephone number of person tested; the test performed; the date of specimen collection; the date of testing; the test results; and the healthcare provider's name and address.

### C. Healthcare Provider Reporting Requirements

NJAC 8:57-1.4 stipulates that healthcare providers report (by telephone, by confidential fax, or in writing) all cases of STEC to the local health officer having jurisdiction over the locality in which the patient lives or, if unknown, to the health officer in whose jurisdiction the healthcare provider requesting the laboratory examination is located. The report shall contain the name of the disease; date of illness onset; and name, age, date of birth, race, ethnicity, home address, and telephone number of the person they are reporting. In addition, name, address, institution and telephone number of reporting official and other information may be required by NJDOH concerning a specific disease.

### D. Local Board of Health Reporting and Follow-Up Responsibilities

NJAC 8:57-1.7 stipulates that each local health officer must report the occurrence of any case of STEC within 24 hours of receiving a report from a laboratory or healthcare provider to NJDOH, IZDP. A report can be filed electronically using the confidential and secure CDRSS.

# 5 CASE INVESTIGATION

## A. Forms

It is the health officer's responsibility to investigate the case by interviewing the patient and others who may be able to provide pertinent information. To obtain relevant information please use the *STEC (including E.coli 0157:H7) Case Report Worksheet* available at: [http://nj.gov/health/cd/ecoli/documents/stec\\_%20worksheet.pdf](http://nj.gov/health/cd/ecoli/documents/stec_%20worksheet.pdf)

- When asking about exposure history (e.g., food, travel, activities), use the incubation period range for STEC (0–8 days). If possible, record any restaurants at which the patient ate, including food item(s) and date consumed.
- In a case of an outbreak, immediately notify the NJDOH, IZDP by telephone at 609.826.5964 during business hours and 609.392.2020 after business hours and on weekends and holidays.
- If there have been several unsuccessful attempts to obtain patient information, please fill out the worksheet with as much information as possible. Please note on the worksheet why it could not be filled out completely. Fax completed report to 609.826.5972.

## B. Entry into CDRSS

The mandatory fields for all cases in CDRSS include: disease, last name, county, municipality, gender, race, ethnicity, case status, report status.

## C. Other Reporting/Investigation Issues

1. Once LHD completes its investigation and assigns a report status of “LHD CLOSED,” NJDOH will review the case. NJDOH will approve the case by changing the report status to “DHSS APPROVED.” At this time, the case will be submitted to CDC and the case will be locked for editing. If additional information is received after a case has been placed in “DHSS APPROVED,” you will need to contact NJDOH to reopen the case. This should be done only if the additional information changes the case status of the report.
2. Every effort should be made to complete the investigation within three months of opening a case. Cases that remain open for three months or more and have no investigation or update notes will be closed by NJDOH.

# 6 CONTROLLING FURTHER SPREAD

## A. Isolation and Quarantine Requirements (NJAC 8:57-1.10)

Food handlers with STEC infection must be excluded from work.

**NOTE: A food handler is any person directly preparing or handling food. This can include a person providing direct patient care (e.g., a nurse who administers medications orally) or a childcare provider.**

### 1. Minimum Period of Isolation of Patient

After diarrhea has resolved, food handlers may return to work only after producing two successive negative stool specimens, collected no less than 24 hours apart but not sooner than 48 hours after completion of antibiotic therapy (if antibiotics are given).

### 2. Minimum Period of Quarantine of Contacts

Contacts with diarrhea who are food handlers shall be considered the same as a case-patient and handled in the same fashion. No restrictions need to be implemented otherwise.

### 3. Controlling Outbreaks

In suspected STEC outbreaks associated with a commercial food establishment, all food handlers who prepared the suspected or implicated meal/food should submit a stool specimen for culture. Personnel who have or who had symptoms of vomiting or diarrhea at the time the suspected food was prepared should be excluded from work immediately. Other food

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handlers who deny illness should be excluded only if they do not submit a stool specimen in a timely manner (usually by the next business day).

Asymptomatic food handlers infected with STEC should be excluded from direct food handling responsibilities until they have at least two consecutive negative stools because of the difficulty in monitoring and ensuring good hygiene. Consideration may be given to allowing such asymptomatic infected food handlers to engage in activities at the food establishment that do not involve direct food handling. IZDP should be consulted in situations where the course of action is unclear.

### B. Protection of Contacts of a Case

None.

### C. Managing Special Situations

#### 1. Daycare

Because STEC may be transmitted person to person through the fecal-oral route, it is important to follow up cases of STEC that occur in a daycare setting carefully. If a case of HUS is diagnosed in a daycare, please see the chapter on HUS for recommendations. General recommendations include the following:

- Children and staff with STEC infection should be excluded until their diarrhea has resolved and two successive stool cultures are negative for STEC collected no less than 24 hours apart but no sooner than 48 hours after completion of antibiotic therapy (if antibiotics are given).
- Infection control procedures including proper hand washing, sanitary disposal of diapers and feces, proper food handling, and environmental sanitation should be implemented.

#### 2. School

Because STEC may be transmitted person to person through the fecal-oral route, it is important to follow up cases of STEC that occur in a school setting carefully. General recommendations include the following:

- Students or staff with STEC infection who have diarrhea should be excluded until their diarrhea has resolved.
- Students or staff with STEC infection who do not handle food, have no 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 has resolved and they have two successive negative stool tests collected 24 hours or more apart, but not sooner than 48 hours after completion of antibiotic therapy (if antibiotics are given).



### **3. Community Residential Programs and Other Institutional Settings**

Actions taken in response to a case of STEC infection in a community residential program will depend on the type of program and the level of functioning of the residents.

In **long-term care facilities**, residents with STEC infection should be placed on standard (including enteric) precautions until their symptoms subside and they test negative for STEC. Staff members who provide direct patient care (e.g., feed patients, give mouth or denture care, or give medications) are considered food handlers and are subject to food handler restrictions (see section 6A above). In addition, staff members infected with STEC who are not food handlers should not work until their diarrhea has resolved.

In **residential facilities** for the developmentally disabled, staff and clients with STEC infection must refrain from handling or preparing food for residents until their diarrhea has resolved and they have two successive negative stool tests for STEC infection (collected 24 hours or more apart, but not sooner than 48 hours after completion of antibiotic therapy, if antibiotics are given).

In addition, staff members infected with STEC who are not food handlers should not work until their diarrhea has resolved.

In addition to reporting an outbreak to the local health department, facility management from **long-term care facilities** must report any such outbreak to the NJDOH Division of Long-Term Care Compliance and Surveillance Program, by telephone at 1.800.792.9770 or fax at 609.633.9060. A written report should be mailed within 72 hours to NJDOH, LTC Compliance and Surveillance Program, PO Box 367, Trenton, NJ 08625.

### **4. Reported Incidence Is Higher Than Usual/Outbreak Suspected**

If the number of reported cases of STEC in a city/town is higher than usual, or if an outbreak is suspected, investigate to determine the source of infection and mode of transmission. A common vehicle (such as water, food, or association with a daycare center) should be sought and applicable preventive or control measures should be instituted. Control of person-to-person transmission requires special emphasis on personal cleanliness and sanitary disposal of feces. Consult with IZDP staff to determine a course of action to prevent further cases and perform surveillance for cases that may cross several jurisdictions that would otherwise be difficult to identify at a local level.

## **D. Preventative Measures**

### ***Environmental Measures***

Implicated food items must be removed from the environment. A decision about testing implicated food items can be made in consultation with IZDP and the Food and Drug Safety Program (FDSP). If a commercial product is suspected, FDSP will coordinate follow-up with relevant outside agencies.

**NOTE: The role of FDSP is to provide policy and technical assistance with the environmental investigation such as interpreting the New Jersey Food Code, conducting a hazardous analysis and critical control points risk assessment, initiating enforcement actions, and collecting food samples.**

## 7 PERSONAL PREVENTIVE MEASURES/EDUCATION

To prevent infection, advise individuals of the following:

- Always wash their hands thoroughly with soap and water before eating or preparing food, after using the toilet, and after changing diapers. (After changing diapers, wash the diapered child's hands.)
- In a daycare setting, dispose of feces in a sanitary manner.
- Caregivers providing care for someone with diarrhea should wash their own hands (and the hands of the person receiving care as appropriate) with plenty of soap and water after cleaning the bathroom, helping the person use the toilet, or changing diapers, soiled clothes, or soiled sheets.
- Avoid sexual practices that may permit fecal-oral transmission. Latex barrier protection should be emphasized as a way to prevent the spread of STEC infection to a case patient's sexual partners, as well as being a way to prevent the exposure to and transmission of other pathogens.
- If diagnosed with STEC, seek medical attention if symptoms compatible with HUS occur. (See chapter on HUS.)
- Wash fruits and vegetables thoroughly, especially those that will not be cooked.
- Cook all ground beef and hamburger thoroughly. Make certain the cooked meat is a gray or brown color throughout (not pink) and the meat juices run clear; the inside should be hot.
- Drink only pasteurized milk, juice, or cider.

### Additional Information

An STEC Fact Sheet can be obtained at the NJDHSS Web site at <http://www.state.nj.us/health>. Click on the "Topics A to Z" link and scroll down to the subject "STEC."

Additional information can be obtained from the US Food and Drug Administration's Center for Food Safety and Applied Nutrition Web site at [www.cfsan.fda.gov](http://www.cfsan.fda.gov).

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