New Jersey Department of Health
Communicable Disease Service

# Shiga toxin-producing *Escherichia coli*

## 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, confirmed cases of listeriosis 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/.

If the health officer is unavailable, the healthcare provider or administrator shall make the report to the Department by telephone to (609) 826-5964, between 8:00 A.M. and 5:00 P.M. on non-holiday weekdays or to (609) 392-2020 during all other days and hours.

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# 1 THE DISEASE AND ITS EPIDEMIOLOGY

## A. Etiologic Agent and Background

*Escherichia coli* are gram-negative bacteria that inhabit the gastrointestinal tract. Most types do not cause illness, but 5 pathotypes are associated with diarrhea: enterotoxigenic *E. coli* (ETEC), Shiga toxin–producing *E. coli* (STEC), enteropathogenic *E. coli* (EPEC), enteroaggregative *E. coli* (EAEC), and enteroinvasive *E. coli* (EIEC). In addition, diffusely adherent *E. coli* (DAEC) might also be associated with diarrhea. *E. coli* serotypes are determined by surface antigens (O and H), and specific serotypes tend to cluster within specific pathotypes. The most commonly reported STEC in the United States is *E. coli* O157:H7 however, there are over 50 other serogroups that can also cause illness.

## B. Clinical Description

### 1. Signs and Symptoms

Signs and symptoms of STEC infection vary but often include bloody/watery diarrhea and severe stomach cramps. Some people also have vomiting or a low fever.

Anyone can get an E. coli infection. But some groups of people have an increased chance of infection and getting seriously ill. These groups include children younger than 5 years, adults aged 65 or older, people who have a weakened immune system, and international travelers.

### 2. Hemolytic Uremic Syndrome

Infection with Shiga toxin-producing *E. coli* can trigger a serious health condition called hemolytic uremic syndrome (HUS). HUS can lead to kidney failure, permanent health problems, and even death.

HUS is a medical emergency. Signs of HUS include little or no peeing, losing pink color in cheeks and inside the lower eyelids, unexplained bruising or rash of tiny red spots, blood in pee, feeling very tired or being irritable (cranky), and decreased awareness (alertness).

## C. Reservoirs

The intestinal tracts of animals, especially cattle and other ruminants, are the primary reservoirs of STEC. People are the main reservoir of non-STEC pathotypes that cause diarrhea in humans.

## D. Modes of Transmission

Diarrheagenic pathotypes can be passed in the feces of humans and other animals. Transmission occurs through the fecal-oral route, primarily via contaminated food or

water and also through person-to-person contact and contact with animals or their environment.

**E. Incubation Period**

A range of one to ten days has been reported, with a median incubation period of three to four days.

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

The infectious period for STEC typically lasts for a week or less in adults, but up to three weeks in about one-third of infected children. Some individuals shed the bacteria for longer but 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. In the United States, STEC causes an estimated 265,000 illnesses each year. In New Jersey approximately 500 cases are reported every year.

# 2 NJDOH CASE DEFINITION

**A. Clinical Criteria**

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).

**B. Laboratory Criteria for Diagnosis**

1. **Confirmatory laboratory evidence:**
   - 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.

2. **Supportive laboratory evidence:**

- 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 culture-independent diagnostic test (CIDT) and no known isolation of *Shigella* from a clinical specimen,

**OR**

- Detection of *E. coli* O157 or STEC/Enterohemorrhagic *E. coli* (EHEC) in a clinical specimen using a CIDT.

**C. 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.

**D. Case Classification**

**1. Confirmed**

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

**2. 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.

**3. Possible**

- Identification of an elevated antibody titer against a known Shiga toxin-producing serogroup of *E. coli* in a person with no known clinical compatibility,

**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 in a person with no known clinical compatibility,

**OR**

- Detection of *E. coli* O157 or STEC/EHEC in a clinical specimen using a CIDT in a person with no known clinical compatibility,

**OR**

- A person with a diagnosis of post-diarrheal HUS/TTP (see HUS case definition).

**Case Classification Notes**

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 classified as a suspect or probable case, regardless of whether detection of Shiga toxin or Shiga toxin genes is confirmed by a public health laboratory.

**E. Criteria for Distinguishing a New Case from an Existing Case**

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. (See formula referenced in Appendix B of the 2017 CSTE Position Statement [17-ID-10] for details on time period calculation, hierarchy of dates and interpretation).

**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.

**F. Differences from CDC Case Definition**

There are no substantive differences between the NJDOH and CDC case definitions; "suspected" cases will be classified as "possible" in CDRSS.

# 3 LABORATORY TESTING

The NJDOH Public Health and Environmental Laboratories (PHEL) will confirm the identification of STEC in stool specimens. PHEL requests laboratories to submit all STEC isolates within three days to aid in public health surveillance (N.J.A.C. 8:57).

The Foodborne and Waterborne Disease Unit (FWD Unit) within the Communicable Disease Service (CDS) will determine if testing of food items implicated in clusters or outbreaks is warranted. NJDOH can help coordinate pickup of food samples and testing at PHEL.

# 4 PURPOSE OF SURVEILLANCE AND REPORTING REQUIREMENTS

- To identify transmission sources of major public health concern (e.g., a restaurant or commercially distributed food product) and to stop transmission.
- To provide education about reducing the risk of infection.
- To identify whether the 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.

# 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 about the case patient's illness. Some of the required information can be obtained from the patient's healthcare provider or the medical record. Much of the information on exposure and food history must be obtained from the patient as it is not likely to be found in the medical record. The STEC Case Report Form (CRF) should be used to complete the case investigation. After completing the case investigation using the CRF, update CDRSS and email the CRF to cds.fwd.epi@doh.nj.gov or fax to (609) 292-5811 or (609) 292-5821.

**B. Update CDRSS**

Please refer to the disease prioritization guidance that provides LHDs with timeframes for public health response and enter critical details on all cases in CDRSS: demographics, signs/symptoms, clinical status, laboratory information, patient location, industry/occupation, and sources of infections and risk factors for STEC. STEC is a Priority Level 3 disease and critical details should be entered into CDRSS within 5 days. If critical details cannot be obtained, local health departments (LHDs) should document the reason for the delay and the anticipated time when these details will be available.

**C. Other Reporting/Investigation Issues**

Once LHD completes its investigation and assigns a report status of "LHD CLOSED," the FWD Unit will review the case and approve the case by changing the report status to "DHSS APPROVED." At this time, the case will be submitted to CDC and locked for editing. If additional information is received after a case has been placed in "DHSS APPROVED," you will need to contact the FWD Unit at NJDOH to reopen the case. This should be done only if relevant exposure becomes available or the additional information changes the case status of the report.

# 6 CONTROLLING FURTHER SPREAD

**A. Isolation and Quarantine Requirements (NJAC 8:57)**

Food handlers with STEC are excluded from handling food until they no longer have symptoms, and they have at least two successive negative stool cultures (collected 24 or more hours apart, but not sooner than 48 hours following completion of antimicrobial therapy).

**B. Protection of Contacts of a Case**

Contacts with diarrhea who are food handlers should be isolated and quarantined in the same manner as a patient (see section 6A) and handled in the same fashion.

**C. Managing Special Situations**

Because STEC may be transmitted person to person through fecal-oral transmission, it is important to carefully follow up cases in daycare settings, schools, and community residential programs, including long-term care and developmental facilities.

1. **Daycare Settings**
   General recommendations include the following:
   - When STEC infection is identified in a childcare attendee or staff person, stool specimens from other symptomatic attendees, staff and household members must be cultured. Symptomatic persons with positive stool cultures for STEC may receive antibiotic therapy. The decision to use antibiotics is based on severity of illness.
   - Children and staff members with STEC should be excluded until their diarrhea has resolved and two successive stool cultures are negative for STEC. These stool specimens should be collected 24 hours or more apart but not sooner than 48 hours after completion of antibiotic therapy.
   - Infection control procedures including proper handwashing, sanitary disposal of diapers and feces, proper food handling and environmental sanitation should be implemented.
   - If more than one person is infected, cohorting should be considered until stool tests are negative.

2. **School Settings**
   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 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 should be placed on standard (including enteric) precautions until their symptoms subside and they have two consecutive negative cultures for STEC. Staff members who give 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 with STEC infection 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 must refrain from handling or preparing food for other residents until their diarrhea has resolved and they have two negative stool cultures 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 with STEC infection who are not food handlers should not work until their diarrhea has resolved.

# 7 OUTBREAK SITUATIONS

If the number of reported cases of STEC in a facility or jurisdiction is higher than usual, or if an outbreak is suspected, LHDs should investigate to determine the source of infection and mode of transmission. A common vehicle (such as food) should be sought, and applicable preventive or control measures should be instituted. NJDOH staff will help determine a course of action to prevent further cases and perform surveillance for cases across jurisdictions that may be difficult to identify at a local level.

Suspected outbreaks should be immediately reported to the LHD where the facility is located. A directory of LHDs with after-hours contact information is available at www.localhealth.nj.gov.

LHDs should immediately notify NJDOH by telephone at (609) 826-5964 during business hours and (609) 392-2020 after business hours and on weekends and holidays.

# 8 PREVENTIVE MEASURES

**A. Environmental Measures**

Implicated food items may be recalled by federal partners and recall notices will be shared by the NJDOH Public Health Food Protection Program (PHFPP) via NJ LINCS. If a commercial product is suspected, PHFPP will coordinate follow-up and provide technical assistance with traceback and environmental investigation (e.g., interpreting the New Jersey Food Code, conducting a hazard analysis and critical control point risk assessment, initiating enforcement actions, collecting food samples).

**B. Personal Preventive Measures/Education**

To avoid future exposure, LHDs should recommend that individuals:

- 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 child's hands as well as their own.
- In a daycare setting, dispose of feces in a sanitary manner.
- When caring for someone with diarrhea, scrub their hands with plenty of soap and water after cleaning the bathroom; helping the person use the toilet; or changing diapers, soiled clothes or soiled sheets.
- Keep flies from contaminating food.
- Anyone with diarrhea should not use a pool or swim in a pond.

**C. International Travel**

The following recommendations can be helpful to travelers in developing countries:

- "Boil it, cook it, peel it, or forget it."
- Drink only bottled or boiled water, keeping in mind that bottled carbonated water is safer than noncarbonated water.
- Ask for drinks without ice unless the ice is made from bottled or boiled water. Avoid popsicles and flavored ices that may have been made with contaminated water.
- Eat foods that have been thoroughly cooked and are still hot and steaming.
- Avoid raw vegetables and fruits that cannot be peeled. Vegetables such as lettuce are easily contaminated and are very hard to wash well.
- Peel your own raw fruits or vegetables and do not eat the peelings.
- Avoid foods and beverages from street vendors.

**References**

1. [NJDOH] NJ Administrative Code: https://www.nj.gov/health/cd/reporting/acode/
2. [NJDOH] General Guidelines for Foodborne Illness in Food Handlers Work Exclusion List: https://www.nj.gov/health/cd/documents/topics/foodborne/foodhandler_exclusion_list.pdf
3. [CDC] STEC (*E. coli*) Webpage: https://www.cdc.gov/ecoli/about/index.html
4. [CSTE] 17-ID-10 Public Health Reporting and National Notification for Shiga Toxin-Producing *Escherichia coli*:
5. (STEC) https://cdn.ymaws.com/www.cste.org/resource/resmgr/2017PS/2017PSFinal/17-ID-10_rev_11-9-2017.pdf
6. Control of Communicable Diseases Manual (Heymann), Diarrhea caused by *E. coli*