

***E. coli* O157:H7 and other Shiga-toxin producing *E. coli* (STEC)**

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Escherichia coli (*E. coli*) O157:H7 is one of over a hundred different serotypes belonging to the group of gram negative bacteria *Escherichia coli*, the majority of which cause no human illness. *E. coli* O157:H7 and a few other serotypes (e.g. O26, O111) produce potent cytotoxins, called Shiga toxins. *E. coli* O157:H7 and other Shiga toxin producing *E. coli* (STEC) are often categorized as enterohemorrhagic *E. coli* (EHEC).

B. Clinical Description

Infection with *E. coli* O157:H7 or other STEC may present with a wide spectrum of clinical manifestations. An individual may be asymptomatic, have mild non-bloody diarrhea, or have bloody diarrhea. Most diagnosed cases present with an onset of bloody diarrhea 6 to 48 hours after the onset of non-bloody diarrhea. Abdominal cramps, nausea and vomiting may also be present. Fever is usually absent. Infection in young children may lead to complications such as hemolytic uremic syndrome (HUS) in approximately 5 to 10% of cases. Please see the chapter on **HUS** for additional information.

C. Reservoirs

Cattle are a reservoir of significant public health importance; however, other animals, such as deer, are also known to carry *E. coli* O157:H7. In addition, humans may also serve as a reservoir.

D. Modes of Transmission

E. coli O157:H7 and other STEC are transmitted via the fecal-oral route through food, drinking water or recreational water contaminated with human or animal feces that contain *E. coli* O157:H7 or other STEC. The infectious dose is very low. Transmission also occurs from person-to-person and from contact with infected animals. *E. coli* O157:H7 has been associated with consumption of contaminated ground beef, unpasteurized apple juice and cider, unpasteurized milk and other dairy products, raw vegetables, and dried meats (e.g. jerky).

E. Incubation Period

The incubation period is 2 to 10 days; most commonly 3 to 4 days.

F. Period of Communicability or Infectious Period

E. coli O157:H7 is shed in stool while a person has diarrhea and then for a variable amount of time after diarrhea has resolved. Adults typically shed for a week or less, however, the bacteria are shed for up to 3 weeks in about one-third of infected children. Prolonged carriage is uncommon.

G. Epidemiology

E. coli O157:H7 was first identified in 1982 in an outbreak in the United States. Sporadic cases of *E.*

Colorado Communicable Disease Manual

ISSUED: 11/8/2004

REVISED: 05/26/2005

PAGE: 2

SUBJECT: *E. coli* O157:H7

coli O157:H7 infection occur throughout the year with a peak during the summer months. Approximately 60-100 cases of *E. coli* O157:H7 and 1-5 other STEC cases are reported in Colorado each year.

Colorado Statistics are available at the CDPHE website:
www.cdphe.state.co.us/dc/CODiseaseStatistics/index.html

2) CASE DEFINITION

Clinical Description

An infection of variable severity characterized by diarrhea (often bloody) and abdominal cramps. Illness may be complicated by hemolytic uremic syndrome (HUS) or thrombotic thrombocytopenic purpura (TTP); asymptomatic infections also may occur.

Laboratory Criteria for Diagnosis

- Isolation of *E. coli* O157:H7 from a clinical specimen (including stool, blood and urine)
- Isolation of Shiga toxin-producing *E. coli* from a clinical specimen

Case Classification

Probable:

- A case with isolation of *E. coli* O157 from a clinical specimen, pending confirmation of H7 or Shiga toxin production, or
- A clinically compatible case that is epidemiologically linked to a confirmed or probable case, or
- Identification of Shiga toxin in a specimen from a clinically compatible case, or
- Definitive evidence of an elevated antibody titer to a known EHEC serotype from a clinically compatible case

Confirmed: A case that meets the laboratory criteria for diagnosis

3) REPORTING CRITERIA

What to Report to the Colorado Department of Public Health and Environment (CDPHE) or local health agency

- Confirmed and probable *E. coli* O157:H7 or other STEC cases.
- *E. coli* O157:H7 cases should be reported within 7 days of diagnosis or a positive laboratory test.
- Cases should be reported using the Colorado Electronic Disease Reporting System (CEDRS), fax or telephone. See below for phone and fax numbers.
- Suspected foodborne/enteric disease outbreaks should be reported to CDHPHE or the local health department within 24 hours, even if the causative agent has not yet been identified.

Purpose of Surveillance and Reporting

- To identify cases for investigation and potential outbreaks
- To monitor trends in disease incidence

Colorado Communicable Disease Manual

ISSUED: 11/8/2004

REVISED: 05/26/2005

PAGE: 3

SUBJECT: *E. coli* O157:H7

Important Phone Numbers and Web Resources

- CDPHE Communicable Disease Epidemiology Program
 - Phone: 303-692-2700 or 800-866-2759
 - Fax: 303-782-0338
 - After hours: 303-370-9395
- CDPHE Microbiology Laboratory: 303-692-3480
- Communicable Disease (CD) Manual website
http://www.cdphe.state.co.us/dc/epidemiology/dc_manual.html

4) STATE LABORATORY SERVICES

Laboratory Testing Services Available

*The services listed below are for public health purposes; clinical laboratories are **not** charged for these services.*

- The CDPHE Laboratory requests all *E. coli* O157 isolates or other STEC+ specimens from clinical laboratories be submitted for confirmation.
- The CDPHE Microbiology Laboratory will test bulk stool or rectal swab specimens for the presence of *E. coli* O157:H7 or other STEC.
- Pulsed Field Gel Electrophoresis (PFGE) testing (i.e., molecular typing) is routinely performed on all *E. coli* O157:H7 isolates.
- For more information contact the CDPHE Microbiology Laboratory.
- **Note:** Authorization from the CDPHE Communicable Disease Program is required before submitting bulk stool, rectal swabs, or implicated food items to the CDPHE Laboratory.
- See Section 6 (E)--Environmental Measures, for more information about food testing.

5) CASE INVESTIGATION

Interview all *E. coli* O157:H7 and STEC cases, including symptomatic contacts of confirmed cases and others whose symptoms are suspected to be caused by *E. coli* O157:H7 or other STEC to determine:

- Potential source of infection, and implement control measures as appropriate
- If others are ill (i.e. Could this be an outbreak?)
- If case may be a source of infection for others (e.g. a high-risk worker or a diapered child), and if so, prevent further transmission

Organized local health departments have primary responsibility for interviews of sporadic cases in their jurisdictions. In other jurisdictions, public health nursing services should consult with regional epidemiologists to establish primary responsibility for interviews of sporadic cases.

For single cases, complete the CDPHE [E. coli O157 / STEC Case Investigation Form](#), or a similar local health agency form. Following patient interviews, complete the CEDRS record for all confirmed and probable cases. If an outbreak is suspected, outbreak-specific interview forms should be used. Please contact CDPHE for assistance.

Colorado Communicable Disease Manual

ISSUED: 11/8/2004

REVISED: 05/26/2005

PAGE: 4

SUBJECT: *E. coli* O157:H7

A. Case Investigation / Forms

Complete all sections of the CDPHE [E. coli O157 / STEC Case Investigation Form](#). Local health departments are encouraged to use the standard CDPHE investigation form.

For agencies that choose to use their own case investigation forms, the report should capture the following information:

- *Demographics (including address, date of birth, ethnicity and race)*
- *Occupation (**High risk occupations include: food service, child care, and health care**)*
- *Childcare or School Attendance*
- *Symptoms and Onset Date*
- *Laboratory (date of specimen collection)*
- *Hospitalization and Medical Treatment Received*
- *Food History (during 2–7 days prior to onset)*
- *Restaurant History (include food items and date consumed)*
- *Farm or Animal Exposure*
- *Travel History (locations and dates)*
- *Drinking Water Source*
- *Recent Group Activities*
- *Contacts with Persons with Gastrointestinal Illness*

B. Identify and Evaluate Contacts

1. Symptomatic Contacts

- Contacts of a confirmed case, who have diarrhea, are probable cases and are treated the same as confirmed cases for disease control purposes. See Section 6--Disease Control Measures.
- Complete a case investigation form on all epidemiologically-linked individuals having symptoms compatible with *E.coli* O157:H7 or STEC.
- Refer symptomatic individuals who have not previously been tested (especially if they are high-risk workers) to their health care providers for stool cultures. If testing will be performed by CDPHE, refer to the [Food and Stool Specimen Collection Instructions](#) on the CD manual website.
- CDPHE recommends that people who are experiencing symptoms submit stool specimens through their health care provider rather than to the state laboratory for several reasons:
 - The patient will receive appropriate medical care for the illness, including antimicrobial therapy, if appropriate.
 - Results will be known more quickly if stool is tested by a commercial laboratory than if tested at the state laboratory.
 - Commercial labs generally perform antimicrobial susceptibility testing, whereas, the state lab does not routinely perform such testing.
- Symptomatic contacts should be entered into CEDRS as probable *E. coli* O157 cases. (It is helpful if you enter the CEDRS ID numbers of the lab-confirmed cases to whom probable cases are epi-linked in the CEDRS case notes.)
- If a common source of infection is suspected, please notify CDPHE.

Colorado Communicable Disease Manual

ISSUED: 11/8/2004

REVISED: 05/26/2005

PAGE: 5

SUBJECT: *E. coli* O157:H7

2. Asymptomatic Contacts

- Ask about sensitive occupations, food handling, childcare, and/or school.
- Provide information about symptoms and preventive measures. See Section 6 (C)-- Education.
- Counsel asymptomatic high-risk workers (e.g., food handlers). Stress importance of good handwashing, personal hygiene, and that they should not work and should notify their supervisor whenever they have a diarrheal illness.
- If an asymptomatic contact who is a food handler works at an establishment with questionable hygienic practices, consider obtaining stool specimens for testing.
- If an asymptomatic contact who is a high-risk worker develops diarrhea, exclude her/him from work, obtain a stool sample, and notify the worker's supervisor.
- Consult with Environmental Health staff and recommend a glove order if necessary.

C. Reported Incidence Is Higher than Usual/Outbreak Suspected

If the number of reported cases of *E. coli* O157:H7 in your jurisdiction is higher than usual, or if an outbreak is suspected, investigate to determine the source of infection and mode of transmission. Consult with a CDPHE Communicable Disease Epidemiologist. CDPHE staff can assist local public health agencies to investigate outbreaks and determine a course of action to prevent further cases, and can coordinate surveillance of cases that cross county lines.

6) DISEASE CONTROL MEASURES

An [E.coli O157:H7 Fact Sheet](#) is available on the CD manual website.

A. Treatment

Antibiotics are generally not indicated for treatment of *E. coli* O157:H7 because they may be implicated in developing HUS. Antimotility agents should not be administered to children with inflammatory or bloody diarrhea. Careful follow-up of patients with hemorrhagic colitis is recommended to detect changes suggestive of HUS.

B. Prophylaxis

No prophylactic treatment of close contacts is recommended.

C. Education

- Cook all ground beef and hamburger thoroughly.
- If served an undercooked hamburger or other ground beef product in a restaurant, send it back for further cooking.
- Avoid consuming unpasteurized milk or other unpasteurized products.
- Educate case and household contacts on proper hand washing techniques.
- Always wash hands thoroughly with soap and water before eating or preparing food, after using the toilet, after changing diapers, and after touching pets or other animals.
- After changing diapers, wash your hands AND the child's hands.
- In a childcare setting, dispose of stool and soiled diapers in a sanitary manner.
- Cases should not prepare food for other individuals until symptoms resolve.
- Keep food that will be eaten raw, such as vegetables, from becoming contaminated by animal-derived food products.

Colorado Communicable Disease Manual

ISSUED: 11/8/2004

REVISED: 05/26/2005

PAGE: 6

SUBJECT: *E. coli* O157:H7

- Avoid sexual practices that may permit fecal-oral transmission. Latex barrier protection should be emphasized as a way to prevent spread to sexual partners as well as being a way to prevent the exposure to and transmission of other pathogens.

D. Managing Special Situations

1. Food Handlers

- When a case of *E. coli* O157:H7 occurs in a food handler, **immediate involvement of public health authorities is critical.**
- Food handlers should be excluded from work until symptoms have resolved and the patient has had two negative stool specimens taken at least 24 hours apart.
- If a case has been treated with an antibiotic, the stool specimen should not be submitted until at least 48 hours after cessation of therapy.
- A letter or memo should be sent to the food service facility documenting the requirements for the infected food handler.

2. Childcare/Preschool

When a case of *E. coli* O157:H7 occurs in a childcare center, **immediate involvement of public health authorities is critical.** Refer childcare providers to the CDPHE **Infectious Disease in Child Care Settings: Guidelines for Child Care Providers** (www.cdphe.state.co.us/dc/epidemiology/dc_guide.asp) for additional *E. coli* O157:H7 information.

- Ill children should not be permitted to re-enter the childcare center until diarrhea has resolved and they have two stool cultures negative for *E. coli* O157:H7 taken at least 24 hours apart. If the child has received antibiotics, the specimens must be submitted at least 48 hours after completion of antibiotics.
- Parents of cases should be counseled not to take their children to another childcare center during this period of exclusion.
- When a case of *E. coli* O157:H7 is identified in a child attending a childcare center, determine whether additional children have or have recently had diarrhea. Other children with diarrhea should be excluded, should be seen by their physician, and should submit stool for culture.
- Since most childcare center staff are considered food handlers, those with *E. coli* O157:H7 infection can return to work after diarrhea has resolved, but must not prepare food or feed children until they have two negative stool cultures taken at least 24 hours apart (and submitted at least 48 hours after cessation of antibiotics, if antibiotics are given). In this situation it is important for Environmental Health staff to work closely with the center to ensure that affected staff do not handle food until cleared by public health. See Section 6 (D1)--Food Handlers above.
- If the case is the only child in the classroom or center who has been ill, no further action is indicated for other children in that classroom or center.
- Reinforce the importance of meticulous handwashing with childcare center staff.

3. School

Refer school personnel to the CDPHE **Infectious Disease Guidelines for School Personnel** (www.cdphe.state.co.us/dc/epidemiology/dc_guide.html) for *E. coli* O157:H7 information.

Colorado Communicable Disease Manual

ISSUED: 11/8/2004

REVISED: 05/26/2005

PAGE: 7

SUBJECT: *E. coli* O157:H7

- Students or staff with *E.coli* O157:H7 infection should be excluded until their diarrhea has resolved.
- If there are concerns about the case's hygiene (e.g. the case has developmental disabilities or behavioral problems) consider obtaining two negative stool cultures at least 24 hours apart before a case returns to class (submitted at least 48 hours after completion of antibiotic therapy, if antibiotics are given).
- Students or staff who handle food and have an *E.coli* O157:H7 infection must not prepare food until their diarrhea has resolved and they have two negative stool cultures taken at least 24 hours apart (submitted at least 48 hours after completion of antibiotic therapy, if antibiotics are given). See Section 6 (D1)--Food Handlers.

4. Community Residential Programs (facilities serving the developmentally disabled)

Actions taken in response to a case of *E.coli* O157:H7 in a community residential program will depend on the type of program and the level of functioning of the residents. In general:

- Residents with *E.coli* O157:H7 should be placed on contact precautions until their symptoms subside and until two negative stool cultures have been obtained at least 24 hours apart.
- Residents with *E.coli* O157:H7 must be excluded from handling or preparing food for other residents until their diarrhea has resolved and they have two negative stool cultures for *E. coli* O157:H7.
- If case being re-tested has received antibiotics, stool should be collected at least 48 hours after antibiotics are completed.
- Staff members who provide direct patient care (e.g., feed patients, give mouth or denture care, or give medications) are considered foodhandlers and are subject to foodhandler restrictions. See section 6 (D1)--Food Handlers.
- Staff members with *E.coli* O157:H7 infection who are not foodhandlers and do not provide direct patient care should be excluded from work until their diarrhea has resolved.

5. Patients and Staff in Health Care Facilities (Hospitals and Long Term Care Facilities)

Hospitals and long term care facilities generally have written infection control policies and procedures for handling cases of communicable disease among patients and staff members. If a facility does not have such policies in place, provide the following recommendations:

- Patients with *E. coli* O157:H7 should be placed on contact precautions until their symptoms subside and they have submitted two negative stool cultures at least 24 hours apart.
- Healthcare workers are generally required to provide two negative stool cultures taken 24 hours apart before returning to work.
- If case being re-tested has received antibiotics, stool should be collected at least 48 hours after antibiotics are completed.

E. Environmental Measures

- Implicated food items must be removed from the environment.
- A decision about testing suspect/implicated food items must be made in consultation with CDPHE Communicable Disease Program.
- If a commercial product is suspected, CDPHE Communicable Disease Program will coordinate follow-up with the CDPHE Consumer Protection Division and relevant outside agencies.

Colorado Communicable Disease Manual

ISSUED: 11/8/2004

REVISED: 05/26/2005

PAGE: 8

SUBJECT: *E. coli* O157:H7

- The CDPHE [Food and Stool Specimen Collection Instructions](#) on the CD manual website.
- The general policy of the CDPHE Laboratory and the Communicable Disease Program is only to test food samples associated with outbreaks, not in single cases.
- For single cases, CDPHE may suggest that the holders of food locate a private laboratory that will test food, or that they store the food in their freezer for a period of time in case additional reports are received.
- The CDPHE laboratory can test food samples associated with isolated cases of illness on a fee for service basis. For more information, contact the CDPHE Microbiology Laboratory.

REFERENCES

American Academy of Pediatrics. *2003 Red Book: Report of the Committee on Infectious Diseases, 26th Edition*. Illinois, Academy of Pediatrics, 2003.

Case Definitions for Infectious Conditions Under Public Health Surveillance.
<http://www.cdc.gov/epo/dphsi/casedef/>

CDC Website: <http://www.cdc.gov/> → click on “Diseases and Conditions”.

Heymann DL, ed. *Control of Communicable Diseases Manual, 18th Edition*. Washington, DC, American Public Health Association, 2004.