

Escherichia coli O157:H7 and other Shiga Toxin-producing E. coli (STEC) Infections

Summary

Shiga toxin-producing *E. coli* (STEC) are diarrhea-causing strains of a group of bacteria called *Escherichia coli*. *E. coli* O157:H7 is the most well-known type of STEC, but there are many other types that can cause illness in humans. While STEC infection has traditionally been associated with animal products, outbreaks associated with produce have become more common.

Agent

- There are many different types of *E. coli*, only some of which are pathogenic to humans. One type of pathogenic *E. coli*, Enterohemorrhagic *E. coli* (EHEC), produces toxins called Shiga toxins (similar to the toxin produced by *Shigella*) and for this reason these *E. coli* are commonly referred to as Shiga toxin-producing *E. coli* (STEC). The most well known type of STEC is *E. coli* O157, but there are many other types that can cause illness, such as *E. coli* O111 and *E. coli* O26.

Transmission

- Reservoir: Cattle are the most important reservoir of STEC; humans may also serve as a reservoir for person-to-person transmission. Other animals including deer, sheep and goats may also carry STEC.
- Mode of transmission: Occurs mainly by ingestion of contaminated food; most often due to inadequately cooked beef (especially ground beef), but also raw milk and fruit or vegetables contaminated with cattle feces. Transmission also occurs directly from person to person via fecal-oral routes, such as in families, restaurants, child care centers, and custodial institutions. Waterborne transmission has also been documented in swimmers in lakes and rivers.
- Period of communicability: For the duration of excretion of the pathogen, this is typically for a week or less in adults but is 3 weeks in one third of children. Prolonged carriage is uncommon. .

Clinical Disease

- Incubation period: Variable; for O157:H7 usually 3 to 4 days with a range of 1 to 8 days.
- Illness: STEC strains cause diarrhea, hemorrhagic colitis, hemolytic-uremic syndrome (HUS) which causes destruction of red blood cells and possible kidney failure, and post diarrheal thrombotic thrombocytopenic purpura (TTP). Illness caused by STEC often begins as nonbloody diarrhea but usually progresses to diarrhea with visible or occult blood. Severe abdominal pain is typical; fever

occurs in less than one third of cases. Hemorrhagic colitis is the most severe intestinal infection caused by *E. coli*.

Laboratory Diagnosis

- *E. coli* O157:H7 can be identified presumptively or specifically by appropriate stool cultures. Clinical laboratories can screen for *E. coli* O157:H7 by using MacConkey agar base with sorbitol substituted for lactose. Approximately 90% of human intestinal *E. coli* strains rapidly ferment sorbitol, whereas *E. coli* O157:H7 strains do not. These sorbitol-negative *E. coli* then can be serotyped, using commercially available antisera, to determine whether they are O157:H7.
- Screening tests for *E. coli* O157 cannot be used to identify other types of STEC. An enzyme immunoassay (EIA) test is available that allows labs to directly test stool specimens for the presence of Shiga toxins, and therefore screen for all types of STEC. However, the Shiga toxin only tests for the presence of Shiga toxin in stool and does not require culturing of the *E. coli* organism. If only the EIA test is performed, there will be no isolate available for serotyping and pulsed field gel electrophoresis (PFGE). Since serotype and PFGE information are crucial to the public health investigation of STEC and the identification of clusters and outbreaks, culture confirmation of positive Shiga toxin EIA tests is recommended.
- Clinical laboratories that detect a diarrhea-associated STEC strain (whether an isolated case or in an outbreak situation) should send the isolate and/or Shiga toxin EIA positive broth to the New Mexico Scientific Laboratory Division (SLD) for isolate confirmation and serotype identification.
- Hemolytic-Uremic Syndrome (HUS). For all patients with HUS, stool specimens should be cultured for *E. coli* O157:H7 and, if results are negative, for other STEC serotypes. However, the absence of STEC in feces does not preclude the diagnosis of STEC-associated HUS, since HUS typically is diagnosed a week or more after onset of diarrhea when the organism no longer may be detectable.

Treatment

- Dehydration and electrolyte abnormalities should be corrected. Orally administered solutions usually are adequate. Antimotility agents should not be administered to children with inflammatory or bloody diarrhea. Careful follow-up of patients with hemorrhagic colitis (including complete blood cell count with smear, blood urea nitrogen level, and creatinine level) is recommended to detect changes suggestive of HUS. If patients have no laboratory evidence of hemolysis, thrombocytopenia, or nephropathy by 3 days after resolution of diarrhea, their risk of developing HUS is low.
- The role of antimicrobial therapy in patients with hemorrhagic colitis caused by STEC is uncertain. Therapy does not seem to prevent progression to HUS, and Trimethoprim-Sulfamethoxazole some evidence suggests that treatment with Trimethoprim-Sulfamethoxazole (TMP-SMX), fluoroquinolones, and certain other antimicrobials may actually precipitate complications such as HUS.

Surveillance

- Case Definition:
Laboratory criteria – Isolation of STEC from a clinical specimen. *E. coli* O157:H7 isolates 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.
Confirmed case – A clinical case that meets the laboratory criteria.
Probable case – 1) a case with isolation of STEC from a clinical specimen, pending confirmation of H7 or Shiga toxin production or; 2) a clinically compatible case that is epidemiologically linked to a confirmed or probable case or; 3) identification of an elevated antibody titer to a known Shiga toxin-producing *E. coli* serotype from a clinically compatible case.
Suspect case – 1) A case of postdiarrheal HUS or TTP or 2) identification of Shiga toxin in a specimen from a clinically compatible case without the isolation of the Shiga toxin-producing *E. coli*.
- Reporting: **Report all suspected or confirmed cases of STEC to the Epidemiology and Response Division (ERD) at 505-827-0006.** Information needed includes: patient's name, age, sex, race, ethnicity, home address, home phone number, occupation and health care provider.
- Case Investigation: Complete the NMDOH STEC Questionnaire and send to Epidemiology and Response Division, P.O. Box 26110, Santa Fe, New Mexico 87502-6110, or fax to 505-827-0013. Investigation information should also be entered into NM-EDSS per established procedures.

Control Measures

For a summary of work and daycare exclusion criteria for all enteric pathogens see Appendix 1.

1. Case management

1.1. Isolation:

1.1.a During acute illness, contact precautions. During outbreaks, contact precautions for infants with diarrhea caused by STEC should be maintained until cultures of stool are negative.

1.1.b Infected patients should not be employed to handle food or to provide child care or patient care until 2 successive negative stool cultures are obtained greater than 24 hours apart and at least 48 hours after antimicrobial therapy is completed, if used.

2. Contact management

2.1. Isolation:

2.1.a Investigation of contacts should generally be limited to food handlers, staff and children in child care centers and other situations where spread of infection is particularly likely. Contacts with diarrhea should be excluded from food handling and the care of children or patients until 2 successive negative stool cultures are obtained greater than 24 hours apart.

- 2.1.b Thorough hand washing after defecation and before food handling or child or patient care should be emphasized for all contacts.
- 2.2. Prophylaxis: Not applicable.
3. Prevention
- 3.1. Heat beef adequately (to 160 degrees) during cooking, especially ground beef.
- 3.2. Emphasize good hand hygiene practices (i.e., proper handwashing after using the toilet, changing diapers, and before and after handling food).
- 3.3. General guidelines for preventing foodborne illness include:
- Thoroughly cook raw food from animal sources;
 - Wash raw vegetables;
 - Avoid unpasteurized dairy products;
 - Wash hands, knives, and cutting boards after handling uncooked foods.
- 3.4. Immunization: Not applicable.

Management of STEC diarrhea in Child Care Centers

1. In an outbreak of diarrhea due to STEC and/or HUS in a child care facility, immediate involvement of public health authorities is critical. Infection by STEC is reportable, and rapid reporting of cases can lead to intervention to prevent further disease.
2. Management of isolated case
 - 2.1. When a case of STEC occurs among a child care center attendee or staff member, the infected person should not be permitted to return to the child care facility until diarrhea has stopped and 2 stool cultures are negative for STEC (obtained greater than 24 hours apart and at least 48 hours after antimicrobial therapy is completed, if used).
 - 2.2. Per child care licensing regulations, a center should notify parents or guardians in writing of a case of STEC in the facility (Subsection D of 8.16.2.20 NMAC).
 - 2.3. Stool specimens from other symptomatic attendees and staff members should be cultured. Contacts with diarrhea should be excluded from food handling and the care of children or patients until 2 successive negative stool cultures are obtained greater than 24 hours apart.
3. The child care center should review its infection control protocols with staff, and emphasize the following:
 - Standard precautions should be followed. Strict hand washing routines for staff and children, and routines for handling fecally contaminated materials.
 - Frequently mouthed objects should be cleaned and sanitized daily. Items should be washed with dishwashing detergent and water, then rinsed in freshly prepared (daily) household bleach solution (dilute 1 cup bleach in 9 cups of water).
 - Food-handling and diaper changing areas should be physically separated and cleaned daily.
 - Diaper changing surfaces should be nonporous and cleaned with a freshly prepared (daily) household bleach solution (dilute 1 cup bleach in 9 cups of water). Cleaning of diaper changing surfaces after each use is required; diapers

- should be disposed of properly. If available, nonporous gloves should be worn when changing diapers.
- Animals in the child care center with diarrhea should be isolated from children and taken to a veterinarian for diagnosis and treatment.
4. The day care operator should be instructed to call the local PHO immediately if new cases of diarrhea occur. The day care center should be called or visited once *each* week for two weeks after onset of the last case to verify that surveillance and appropriate hygienic measures are being carried out.
 5. Outbreak
 - 5.1 If an outbreak of STEC diarrhea (i.e., 2 or more cases) is suspected in a child care facility, the Epidemiology and Response Division should be notified immediately. Outbreaks of STEC in this situation would ordinarily be controlled by exclusion and evaluation of symptomatic children and staff.

References

American Academy of Pediatrics. Pickering LK, ed. 2006 Red Book: Report of the Committee on Infectious Diseases. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2006.

Heymann, DL, ed. Control of Communicable Diseases Manual. 18th edition. Washington, DC: American Public Health Association; 2004.

For a summary of the clinical characteristics of common enteric pathogens, see Appendix 1.

SHIGA TOXIN-PRODUCING *E. coli* (STEC) INFECTIONS

What are STEC infections?

STEC (for example, *E. coli* O157:H7) are a group of *E. coli* bacteria that can cause bloody diarrhea, severe complications and sometimes death. Not all types of *E. coli* cause illness.

What are the symptoms of an STEC infection?

The symptoms usually start within 3-4 days, but the range is 2 to 8 days after exposure. The most common symptoms are stomach cramps and bloody diarrhea. Sometimes persons will also have fever, chills and vomiting. Some persons will not have any symptoms, or they may have mild diarrhea that is not bloody. In a small number of cases, the infection may cause the kidneys to stop working, especially in young children.

How is STEC spread?

STEC bacteria may be spread by eating “dirtied” or contaminated water or food (particularly ground beef or raw milk). Infected persons can spread the bacteria by not washing their hands after going to the bathroom and then handling food that other people will eat. Another way to get this disease is by having direct contact with stool (feces) from an infected person or animal and then transferring the bacteria to the mouth from the hands.

How long are people contagious?

An infected person may spread the bacteria to others for as long as the bacteria remain in the stool, usually 1 week but up to 3 weeks or more.

Who gets STEC infections?

Anyone can get STEC but it is recognized more often in children than adults. Because there are many different strains of STEC, people can become re-infected.

What treatment is available for people with STEC?

Most STEC infections will go away without treatment. If you have bloody diarrhea, you should see a doctor. Persons who get STEC should not take antibiotics. Persons with diarrhea should drink plenty of fluids.

Do infected people need to be kept home from school, work or daycare?

Since the bacteria is found in stool, children should *not* go to daycare or school while they have diarrhea and food handlers should be excluded from work. Daycare attendees and workers and food handlers should only return to daycare/work after 2 negative stool culture results.

How can I protect myself and my family from getting STEC?

- Wash hands frequently with water and soap, and especially after using the toilet, changing a diaper, or before preparing and/or eating food. (Sanitizing gel may be substituted when hands are not visibly soiled.)
- Avoid food or water from sources that may be contaminated.
- Wash raw fruits and vegetables prior to eating or chopping.
- Always treat raw poultry, beef and pork as if they are contaminated and handle accordingly.
- Wrap fresh meats in plastic bags at the market to prevent blood from dripping on other foods.
- Refrigerate foods promptly; minimize time kept at room temperature.
- Immediately wash cutting boards and counters used for preparation to prevent cross contamination with other foods.
- Ensure that the correct internal cooking temperature is reached, particularly when cooking using a microwave.



Epidemiology and Response Division
505-827-0006

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INFECCIONES POR SHIGA TOXIN-PRODUCING *E. coli* (STEC)

¿Qué es la STEC?

STEC (por ejemplo, *E. coli* O157:H7) son un grupo de bacteria que puede producir diarrea con sangre, complicaciones severos y, algunas veces, muerte. No todos los tipos de *E. coli* causan enfermedades.

¿Cuáles son los síntomas de una infección por STEC?

Los síntomas pueden aparecer entre 2 y 8 días después de haber estado expuesto, pero suelen aparecer entre 3 y 4 días. Los síntomas más comunes son retorcijones en el estómago y diarrea con sangre. A veces, también puede darse fiebre, escalofríos y vómitos. Algunas personas pueden no tener ningún síntoma o sólo tener una diarrea leve pero sin sangre. En un pequeño número de casos, la infección puede afectar a los riñones y causar que éstos dejen de funcionar, especialmente en niños pequeños.

¿Cómo se transmite la STEC?

STEC se puede transmitir al comer comida o beber agua contaminadas (sucias), especialmente si es carne molida de res o leche no pasteurizada. Las personas infectadas pueden transmitir la bacteria si no se lavan las manos después de ir al baño y entonces tocan la comida que otros van a comer. Otra forma de contraer esta enfermedad es por contacto directo con las heces de una persona o animal infectados, después de tocarlos se transfiere la bacteria de las manos a la boca.

¿Por cuánto tiempo puede alguien contagiar a otros?

Una persona infectada puede transmitir la bacteria a otros mientras ésta se encuentre presente en las heces, normalmente durante una semana pero puede ser hasta tres semanas o más.

¿Quién puede contraer una infección por STEC?

Cualquiera puede contraerla, pero es más frecuente en niños que en adultos. Como hay muchos tipos diferentes de la bacteria STEC, puede volver a ocurrir en cualquier momento.

¿Cómo se trata una infección por STEC?

La mayoría de infecciones por STEC desaparecen sin ningún tratamiento. Las personas infectadas por STEC no deben tomar antibióticos. Si usted tiene diarrea con sangre, vaya a un médico. Las personas que tienen diarrea deben beber muchos líquidos.

¿Es necesario quedarse en casa y no ir a la escuela, a la guardería o al trabajo?

La bacteria está presente en las heces, por eso los niños **no** deben ir a la guardería o a la escuela mientras tengan diarrea. Las personas que trabajan manipulando alimentos no deben ir al trabajo. Los niños y trabajadores de la guardería, y los manipuladores de alimentos podrán regresar cuando tengan dos resultados negativos en sus pruebas de heces y la aprobación de las autoridades de salud pública.

¿Cómo puedo protegerme yo y también proteger a mi familia contra estas infecciones?

- Lávese las manos con frecuencia con agua y jabón, sobre todo después de usar el baño, cambiar pañales y antes de preparar o comer alimentos. (En lugar de lavárselas puede usar un gel desinfectante para manos cuando no se vean sucias).
- Evite agua o comida que puedan provenir de fuentes contaminadas.
- Lave las frutas y verduras antes de comerlas o cortarlas.
- Siempre trate la carne de pollo, pavo, res y puerco con precaución, como si estuviera contaminada, y manipule de forma adecuada.
- Ponga la carne cruda dentro de bolsas de plástico cuando la compre en el mercado para que la sangre de ésta no se mezcle con otros alimentos.
- Ponga los alimentos en el refrigerador pronto, deben pasar el menor tiempo posible fuera.
- Lave inmediatamente los tableros para cortar y mostradores que ha usado para preparar estos alimentos, de esta forma evita que otros alimentos se puedan contaminar.
- Asegúrese de que la carne alcanza la temperatura interna correcta cuando se cocina, sobre todo si usa un microondas para cocinarla.



